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POWER PLANT OF THE W. H. McELWAIN CO.

Factory Plant in Manchester, N. H., Employing Bleeder Turbines and Westinghouse-Le Blanc Condenser System

BY CHAS. L. HUBBARD

NOW in the process of construction, the new power plant of the W. H. McElwain Company, at Manchester, N. H., represents the highest type of equipment for the generation of power by steam for industrial purposes.

This factory, which is to be devoted to the manufacture of high grade shoes, will, when completed, include 15 buildings, 5 stories in height, having a total floor area of approximately 1,250,000 sq. ft. In addition to this, future development includes a large tannery upon an adjacent lot.

Electric power transmission is to be used between the power house and the different buildings, the current being furnished by generators driven by direct-connected steam turbines.

General Arrangement

GENERAL arrangement of the boiler and engine rooms is shown in plan in Fig. 1. At the present time there have been installed 3 300-hp. water-tube boilers and one 1000-kw. turbo-generator outfit. The boiler room contains sufficient space for a fourth 300-hp. unit, as indicated by dotted lines. The completed plant will include duplicates of the 2 batteries shown, making a total of 2400 hp. The future boilers will face those already installed, the building being ex-

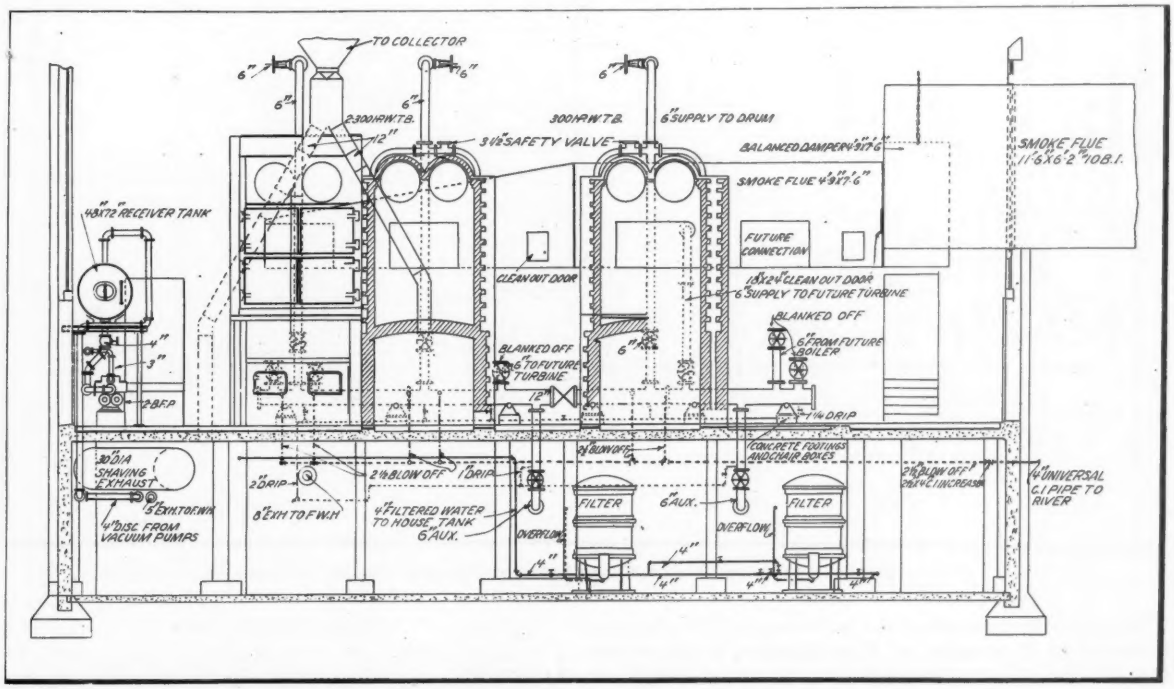

FIG. 5. SECTIONAL ELEVATION THROUGH BOILER ROOM AND BASEMENT

tended for this purpose, and the firing space shown will be common to both sections.

The chimney, which is 176 ft. in height, with a flue 9 ft. in diameter, is designed with refernce to the final capacity of the plant. In the engine room, at the right, is shown space for 2 additional generating units, which provide for an ultimate capacity of 3000 kw. Sectional elevations, showing the boilers, turbines, and the various auxiliary equipment and their connections are illustrated in Figs. 2, 5 and 6.

Boilers

PRESENT equipment consists of 3 Babcock & Wilcox water-tube boilers, each containing 2972 sq. ft. of heating surface and about 50 sq. ft. of grate surface. The heating surface is made up of 2 steam drums, tubes, and mud drum, and a superheater of the form shown in Fig. 2.

boiler is provided with a water column fitted with high and low water alarm, try cocks, and gage glass with special device for shutting off in case of breakage. Also 3½-in. lock pop-safety valve, and 12-in. steam gage reading to 300 lb. pressure. The feed pipes are 2-in. in diameter, provided with both check and gate valves, the latter having special extension handles. The blowoff connections are of 2½-in., extra heavy pipe, and are each provided with 2 blowoff valves of special design.

Boiler settings are of hard burned brick, laid in cement mortar, consisting of 1 part cement to 3 of sand, up to the level of the grates, and in lime mortar above that point. All parts of the furnaces and setting exposed to the fire are lined with firebrick laid in fire clay. The furnaces are of the "Dutch Oven" type as shown in Fig 2.

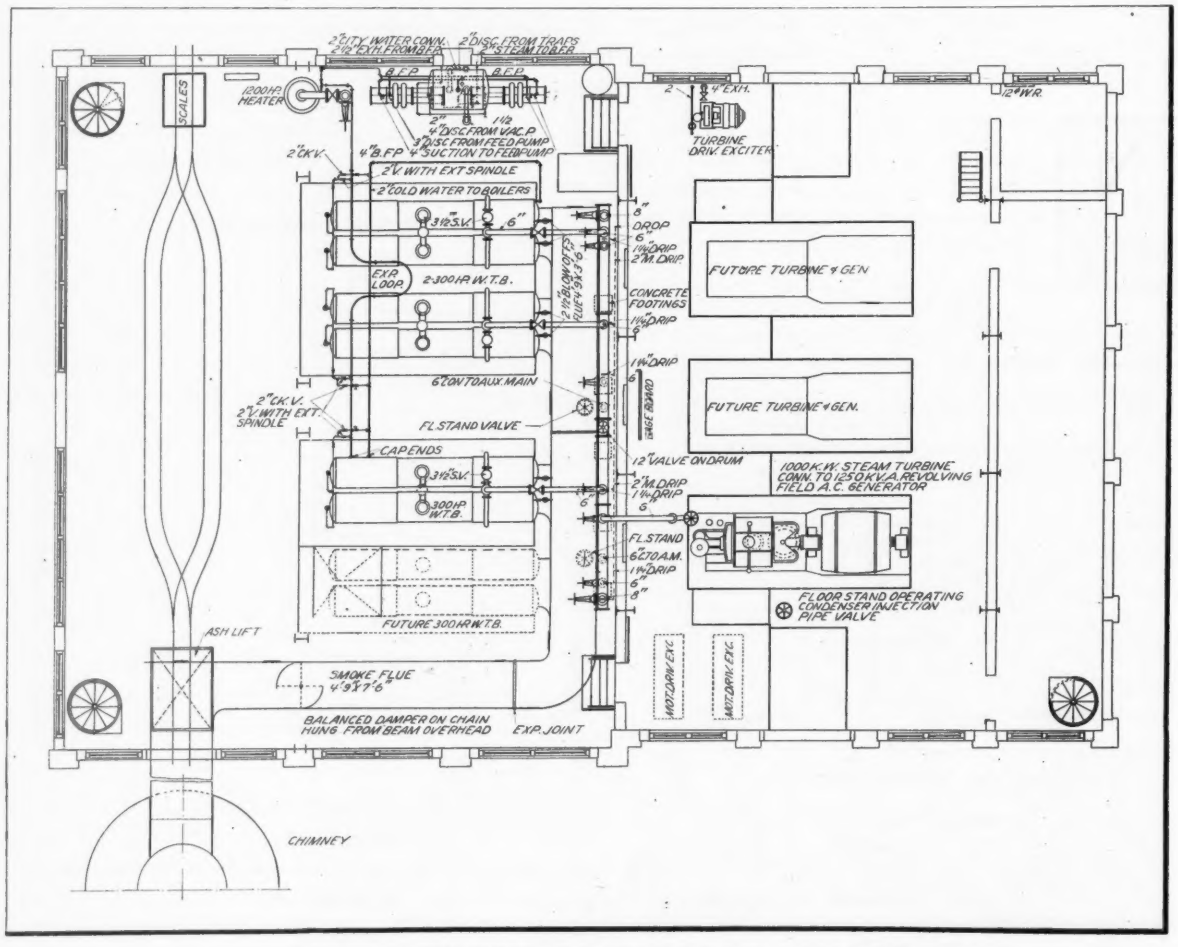

FIG. 1. GENERAL ARRANGEMENT OF BOILER AND ENGINE ROOMS

Each boiler contains 144 4-in. tubes, 18 ft. in length, made up in 12 sections of 12 tubes each, and 2 steam drums 3 ft. in diameter by 20 ft. 4 in. in length. The superheaters each contain approximately 372 sq. ft. of surface, which is 12½ per cent of the heating surface of the boiler, and are designed to give 100 degrees superheat when the boilers are operated at their normal rating of 300 hp. The proportions of all parts are designed for a working pressure of 160 lb. per square inch and the safety valves are set at that point. Each

Smoke Connections

LOCATION of the main smoke flue is best shown in Fig. 1. It is 4 ft. 9 in. by 7 ft. 6 in. in size and constructed of No. 10 black iron. It is stiffened with angle iron braces and supported from the roof. The uptake from each boiler is provided with an adjusting damper for hand manipulation from the floor level.

A balanced damper is located in the main flue at the point indicated, and operated by an automatic

regulator of the hydraulic type. An interesting detail in connection with this work is the method of attaching the covering to the lower side of the flue so that it will not sag or peel off. This consists of cross pieces of 1-in. tee bar placed 24 in. apart and riveted to the flue. The projecting flanges of these bars are drilled at frequent intervals and wires strung through, to which the covering is attached.

Handling of Fuel and Ash

COAL is brought to the fire room by cars running on a special track as shown in Fig. 1. This track passes over platform scales just inside the building where each load may be weighed as it is brought in. The track is double within the fire room so that the cars may pass, and also to furnish storage space for both coal and ash cars when so desired.

The arrangement for the removal of ash is best shown in Figs. 1 and 2. A dumping chute is provided in the bottom of each ash pit and at such an elevation that a car may be run underneath it as indicated. When filled, they are pushed to the ash lift (see Fig. 1) where they are raised to the boiler room level and run out on the coal track for disposal. Waste from the factory, which is combustible, is brought through a 36-in. pipe to a collector placed in the upper part of the boiler room, as shown in Fig. 2, and fed into the furnaces as there indicated.

Turbine and Generator

THE turbo-generator unit is of the Westinghouse make, of 1000 kw. capacity, and equipped with an automatic bleeder connection and constant pressure valve. It is 6 ft. 6 in. in width by 24 ft. 8 in. in length, and weighs approximately 79,000 lb. It is of the regular Westinghouse-Parsons type, the most interesting feature being the bleeder attachment which adapts it for use in combined power and heating plants. An important requirement for the economical operation of the ordinary steam turbine is the maintenance of a high vacuum at the exhaust end, which of course prevents the utilization of exhaust steam for heating purposes. The action of the bleeder attachment above noted is made clear by reference to the diagram shown in Fig. 3. The only difference between this and the standard form of turbine is the introduction of a division wall, A, between the intermediate and low-pressure stages. Strip packing is provided at B, forming a labyrinth without mechanical contact. By this arrangement, steam may enter the heating system at the pressure in chamber J through the opening C. D is an automatic by-pass valve admitting steam from J to the low-pressure section of the turbine under certain conditions, as described below. Valve D is controlled by the pressure it is desired to carry on the heating system, the proper adjustment being made by means

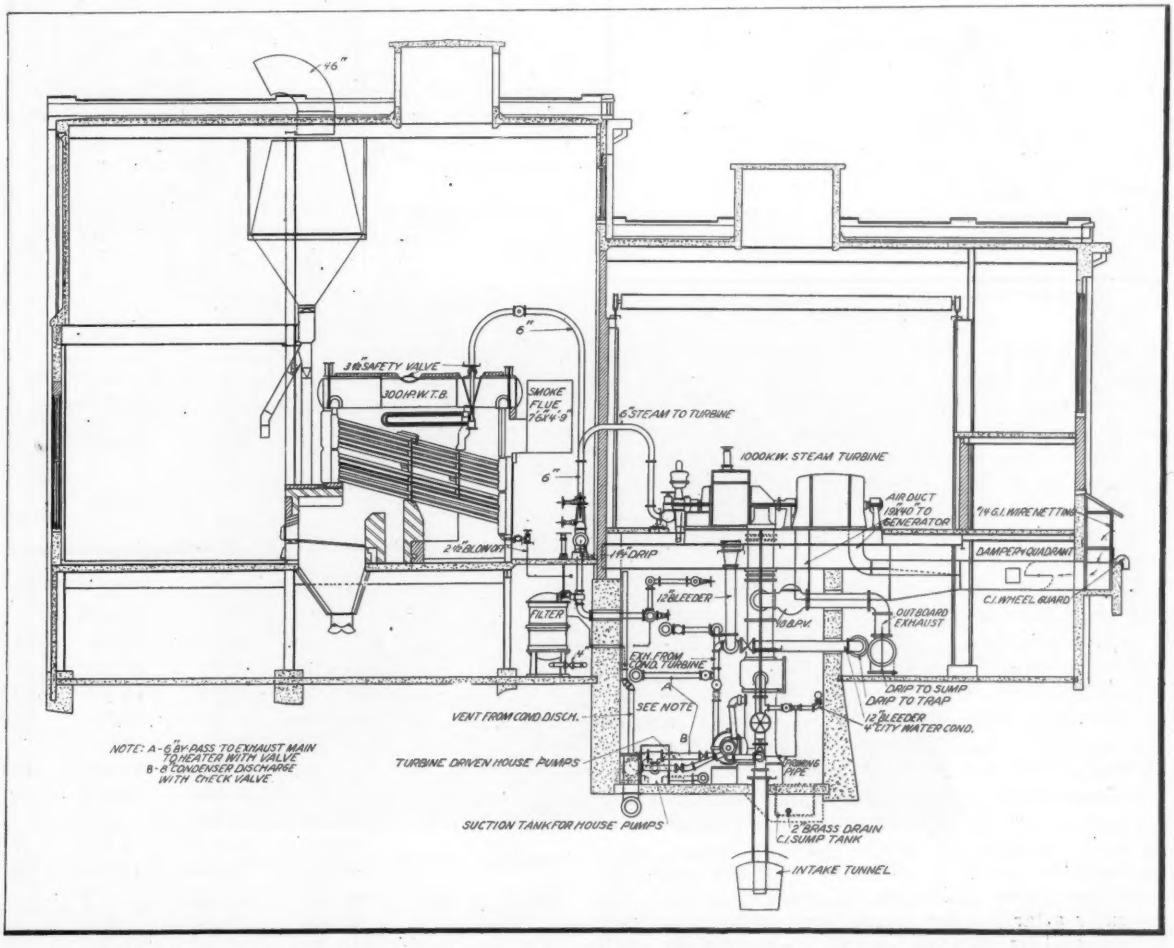

FIG. 2. SECTIONAL ELEVATION THROUGH BOILER AND ENGINE ROOM SHOWING STEAM PIPING AND CONDENSER CONNECTIONS

of the weight H, and acts in 2 ways. Under normal conditions this valve will remain partly open, with sufficient steam flowing to the heating system through C to maintain the desired pressure, while the remainder passes by way of D into the low-pressure section of the turbine.

If more steam is required in the heating system the pressure in J will drop slightly thus closing D to a certain extent and throwing more steam into the heating main through C. If less steam is required, and the pressure in J rises, valve D will open and allow a greater proportion to pass into the low-pressure section. Valve D also opens and closes in connection with the governor valve, which by-passes steam from

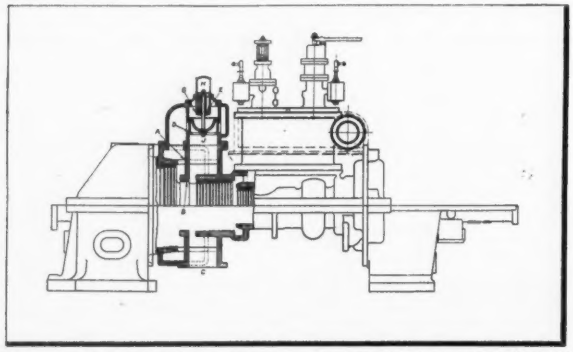

FIG. 3. PART SECTIONAL VIEW OF WESTINGHOUSE AUTOMATIC BLEEDER TURBINE

the high-pressure to the intermediate section of the turbine as the load increases.

For example—an increase in load, tending to reduce the speed, will cause high-pressure steam to be admitted to the intermediate section, which in turn will open valve D to a greater extent and increase the flow of steam into the low-pressure section, thus increasing the power of the turbine sufficiently to meet the demand.

The capacity of the turbine under different conditions is as follows: With a throttle pressure of 150 lb. per square inch, (gage), a vacuum of 28 in., 100 degrees of superheat, and a speed of 3600 r.p.m. the normal capacity when condensing, is 1500 b. hp., and the maximum 2250 b. hp. When running noncondensing, with a back pressure not exceeding that of the atmosphere, the maximum capacity is 1500 b. hp.

It is interesting to note the probable steam economy of a turbine of this type when operating under varying loads, as expressed in the guarantee placed upon this machine, which is as follows: When operating under the above conditions, in connection with the generator attached, the steam consumption per hour, including all leakage and loss within the turbine, shall not exceed the quantities given below:

Load, Per cent	Power Factor, Per cent	Kw.	Lb. Steam, Kw. hr.
150	80	1,500	18.8
125	80	1,250	18,3
100	80	1,000	17.9
75	80	750	18.8
50	80	500	20.7

When operating under the same general conditions, with 3 lb. gage pressure at the bleeder connection, the steam consumption per hour shall not exceed the following at the loads indicated, when withdrawing the following amounts of steam through the bleeder connection:

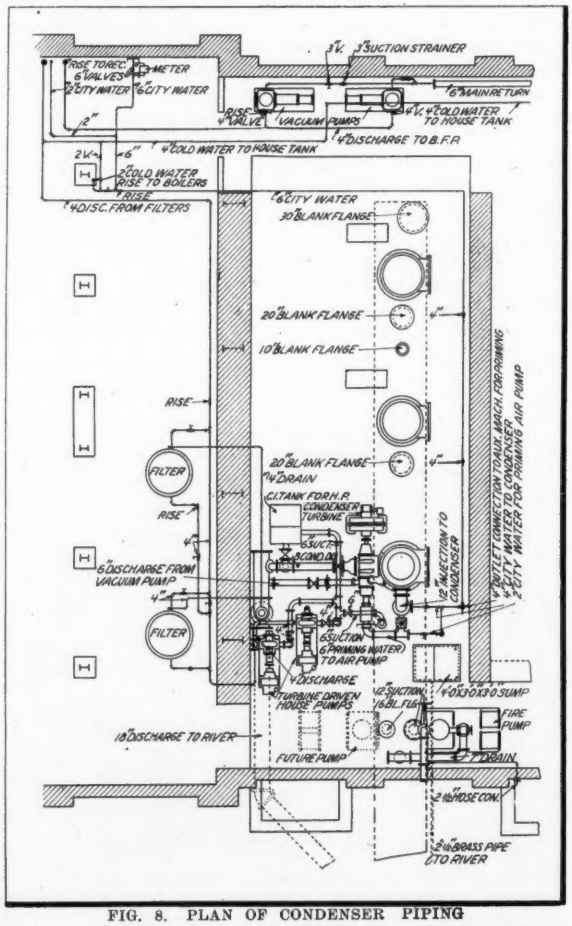

FIG. 8. PLAN OF CONDENSER PIPING

Load, Per cent	Kw.	Pounds of Steam To Throttle	Pounds of Steam To Bleeder	Steam to Condenser Total	Steam to Condenser Kw.
150	1,500	38,000	18,600	19,400	12.9
		31,000	10,000	21,000	14.0
125	1,265	38,000	22,000	16,000	12.7
		36,300	20,000	16,300	12.9
		29,200	10,000	19,200	15.2
100	1,000	37,200	30,000	7,200	7.2
		30,000	20,000	10,000	10.0
		24,400	10,000	14,400	14.4
75	716	30,500	30,000	500	0.7
		25,600	20,000	5,600	7.8
		20,200	10,000	10,200	14.2
50	469	21,700	21,700	0	0
		20,600	20,000	600	1.3
		16,000	10,000	6,000	12.8

Generator

THE generator is of the revolving-field type with enclosed frame, generating a 3-phase, 60-cycle alternating current of 600 volts. The efficiency rating, with a power factor of 100 per cent, is as follows:

Load per cent	Efficiency per cent
50	90.10
75	93.00
100	94.50
125	95.50
150	95.75

Temperature rise based on its normal rating, and a power factor of 80 per cent, for periods of different length and for various loads is given below:

Load, per cent	Length of Run, hours	Temp. Rise, Deg. F. Arm.	Field
100	24	72	72
125	24	90	90
150	1	108	108

The maximum conditions of continuous operation for a room temperature of 77 deg. F. are as follows, with a power factor of 80 per cent. Output, 1250 kw. (25 per cent overload). Rise in temperature:

Armature, 90 deg. F.

Field, 90 deg. F.

Maximum temperature to which insulation can be subjected without injury:

Armature, 194 deg. F.

Field, 302 deg. F.

There are 2 exciters provided, one being turbine driven and having a normal capacity of 25 kw. The other is motor driven, with a capacity of 40 kw. The turbine is of the Westinghouse make, horizontal type, with a normal capacity of 38 b. hp. at a speed of 3500 r.p.m. when running noncondensing, and a continuous overload capacity of 25 per cent. The steam requirements for this machine as regards temperature and pressure are the same as for the main turbine.

The exciter is a direct-current machine with shunt winding, generating a current of 125 volts at full load.

Condensing Apparatus

IN connection with the main turbine a Westinghouse-LeBlanc jet condenser is used and is shown in elevation in Figs. 2 and 6. This is designed to operate under a normal lift of 18 ft. and takes its water supply from the intake tunnel as shown. When using injection water at a temperature of 70 deg. F. the following results are guaranteed, with a water consumption not exceeding 724,000 lb. per hour:

Steam Condensed per hour, lb.	Vacuum Maintained, Inches (Barometer 30 in.)
10,350	28.65
14,100	28.44
18,000	28.17
19,950	28.00
22,900	27.80
30,000	27.11

The vacuum air pump is of the turbine type and is mounted upon the same shaft with the centrifugal ejector pump, both being driven by a steam turbine of 41 b. hp. running at 1500 r.p.m. under an atmospheric exhaust pressure. This piece of apparatus is shown at the base of the condenser in Figs. 2 and 6.

High-Pressure Piping System

THIS includes all high-pressure piping in the boiler and engine rooms for the supply of turbines, pumps, etc., and for the supplementary supply to the heating system as may be needed. Pipe used for this purpose is full weight, wrought iron being used for sizes below 6-in. and open-hearth steel for larger sizes. The main drum at the rear of the boilers is of cast gun iron with nozzles cast in place. Expansion is provided for, so far as possible, by the use of sweep pipe bends and fittings of the long turn pattern. All 2½-in. fittings, and larger, being of this design with flange joints. The high-pressure connections are shown in Figs. 1, 2 and 7. Starting at the boilers (Fig. 2) 6-in. leads are carried to a 12-in. drum supported on low piers and rolls at the rear of the boilers. From here a 6-in. branch leads to the main turbine, and 2 branches of the same size to a 6-in. auxiliary main, running beneath the engine room floor, near to, and parallel with, the boiler room wall. From this auxiliary main are taken the supplies to the various minor turbines and pumps, and also the branches leading to the low and intermediate-pressure system through reducing valves. The main drum is divided into 2 sections by means of a valve at the center, and each of these sections is connected with

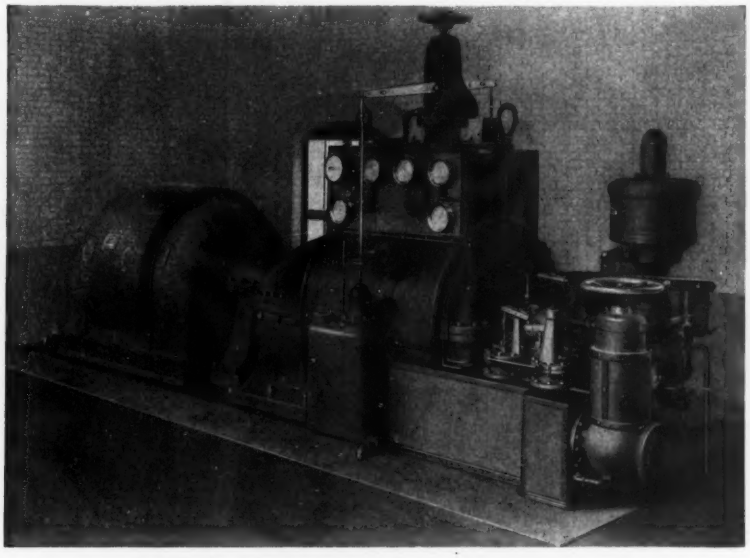

FIG. 4. WESTINGHOUSE AUTOMATIC BLEEDER TURBO-GENERATOR UNIT

the auxiliary drum as shown in Figs. 5 and 7. The supplies to the various pumps are easily traced from Fig. 7, also the connections with the 18-in. heating main and the intermediate-pressure line, leading to the factory through the tunnel leaving the building at the upper right hand corner of the drawing.

Exhaust System

ALL low and intermediate-pressure piping is full weight, sizes up to, and including, 12-in. being of wrought iron, while open-hearth steel is employed for the larger sizes. Standard weight fittings are used for this work, those 6-in. and over being of the long turn pattern. Flange joints are provided on all piping 2½ in. and larger in diameter, the same as for high-pressure work. The exhaust piping is most clearly shown in Figs. 2, 6 and 7. Refering to Fig. 7, the 18-in. exhaust from the main turbine is shown as leading through a back-pressure valve into a 30-in. outboard line designed for the completed plant. This is clearly shown in elevation in Fig. 6. An 8-in. auxiliary exhaust connecting with the various pumps is shown in Fig. 6, parallel with, and below, the auxiliary high-pressure main already described. Steam from this enters the heating system through an oil separator. The 12-in. bleeder connection from the turbine leads to the 18-in. heating main and is shown in the same drawing, although more clearly in Fig. 7.

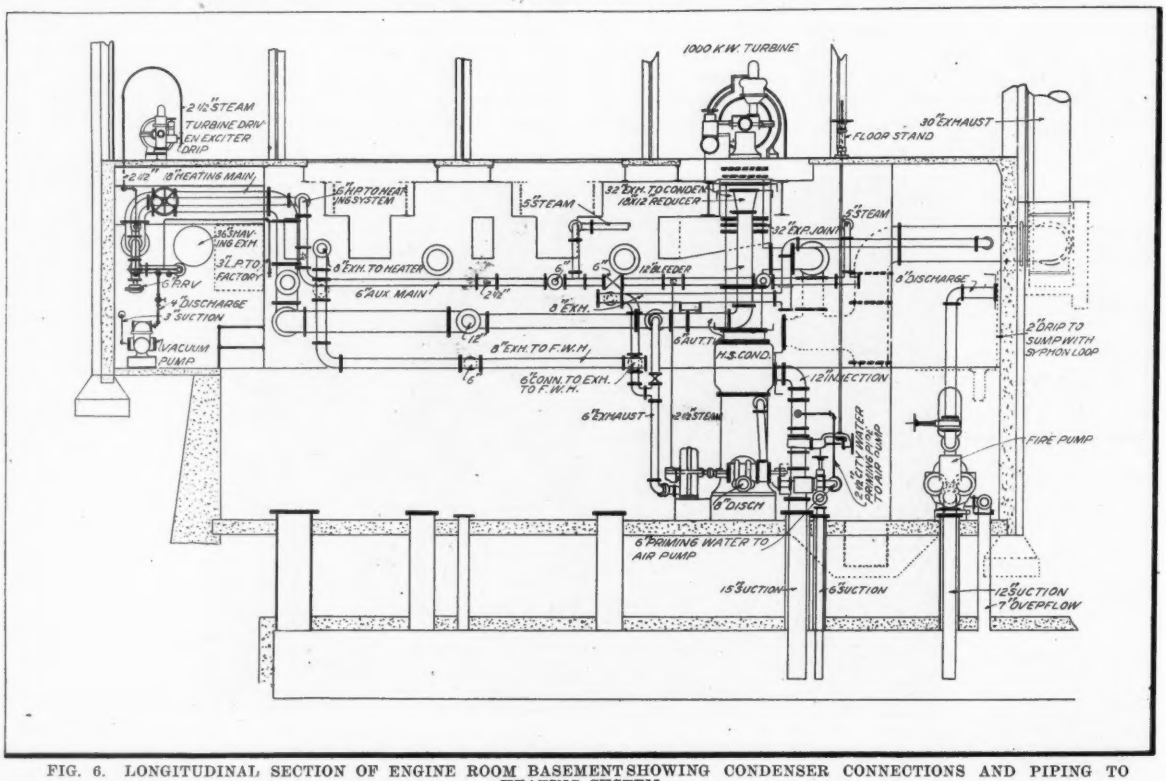

FIG. 6. LONGITUDINAL SECTION OF ENGINE ROOM BASEMENT SHOWING CONDENSER CONNECTIONS AND PIPING TO HEATING SYSTEM

Drainage

BLOWOFF main from the boilers is carried directly to the river through a 4-in. cast-iron pipe. Drips from high-pressure piping are trapped to the main receiving tank and pumped back to the boilers. Exhaust drips, and all condensation containing oil, are trapped to a cast-iron sump tank located in the condenser pit, and, together with other drainage, are discharged by means of a water ejector.

Water Supply, Feed Piping, etc.

WATER for condensing and fire purposes is brought from the river through a cement conduit, a section of this, together with the 15-inch suction to the condenser, being shown in Figs. 2 and 6. The discharge from the condenser pump is into an 18-in. pipe leading to the river, and shown in section in Fig. 2. Water pressure for fire protection is furnished by an 18 by 10 by 12-in. Underwriters' fire pump of 1000 gal. capacity, placed in the condenser pit; this is shown in elevation in Fig. 6, and in plan in Fig. 7 and takes its supply from the intake tunnel as there shown.

The house tank and boilers have 2 sources of supply, one directly from the city mains and a second from the intake tunnel. There is also a tank arrangement whereby water may be drawn from the discharge pipe of the condenser pump.

These various lines are shown in Fig. 8. A 6-in. connection from the city main enters at the upper part of the drawing, toward the left, and after passing through a meter, branches are carried to the house tank, the receiving tank, the boilers and to the priming pipes of the condenser and vacuum pump.

The second source of supply, that from the intake tunnel, requires the use of 2 turbine-driven house pumps of the one-stage turbine type, located in the condenser pit and best shown in Fig. 8. These pumps each have a capacity of 200 gal. per minute against a head of 150 ft., and discharge into a line of piping having branches connecting with the house tank, receiving tank, and boiler feed pipe. A filtering equipment is also provided, as shown in Fig. 8 and so connected that the water from this source may be purified if desired.

Boiler Feed

FEED lines connecting with the boilers are shown in Fig. 1. One of these supplies water either directly by city pressure or from the turbine house pumps. The other supply is from a pair of boiler feed pumps connecting with a receiving tank located in the boiler room as shown. The feed pumps, 2 in number, are of the duplex, outside packed, pot-valve type, 8 by 5 by 10 in. in size. The tank is 4 ft. in diameter by 6 ft. in length, of 3/8-in. iron plate, and is connected with both city pressure and the house pumps. Under ordinary working conditions the feed supply is first discharged into the tank and then pumped to the boilers through a heater of 1000 hp. capacity located as shown.

Insulation

IN general, tanks, heaters, etc., are covered with 85 per cent magnesia blocks, finished with a plastic coat of the same material, the total thickness of the covering, when finished, being 2 in. In addition to this, tanks and heater are provided with a covering of 7-oz. canvas. The insulation on that portion of the smoke pipe which comes outside the building is protected by a covering of heavy sheet-iron. Steam piping, both high and low-pressure, is insulated with 85 per cent magnesia sectional covering. All cold water piping, with the exception of the connections to condenser, are covered with wool felt, having a lining of tarred paper. Pipe covering of all kinds is finished with a heavy canvas jacket, and painted.

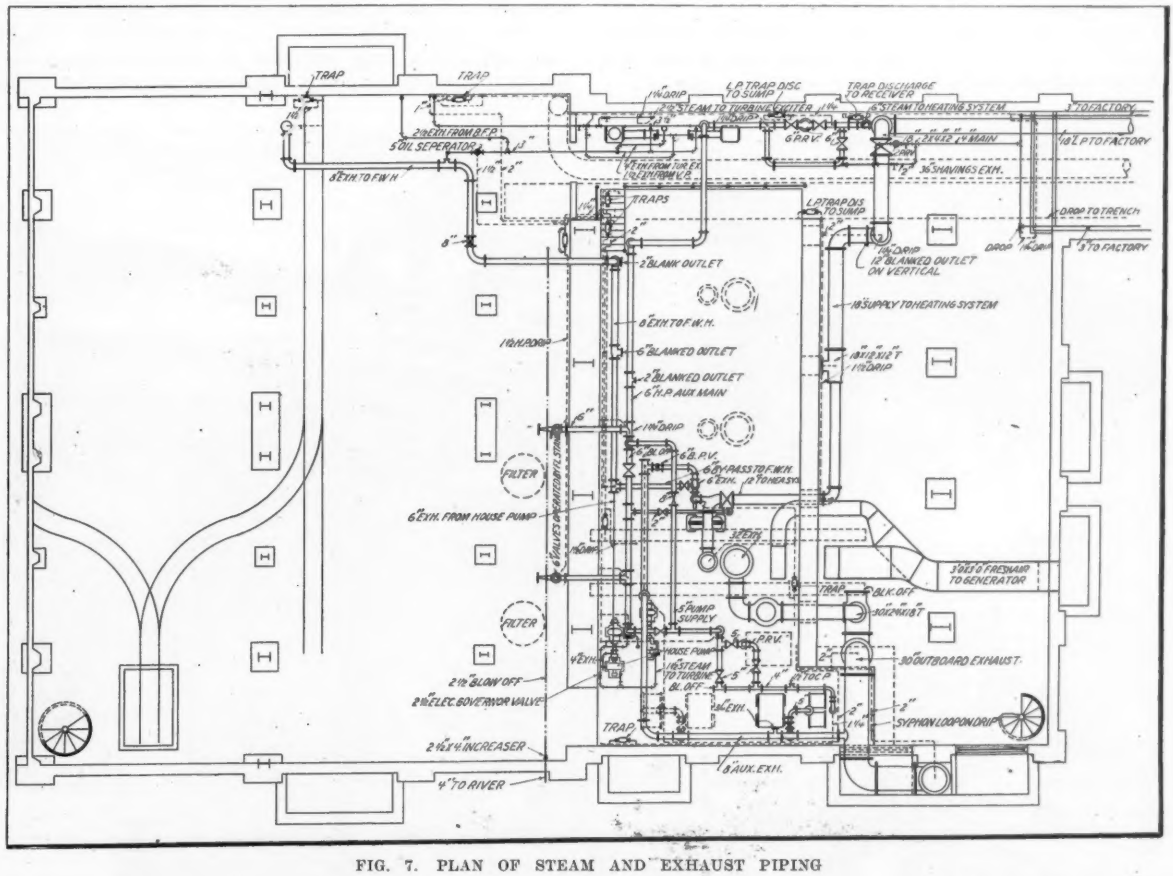

FIG. 7. PLAN OF STEAM AND EXHAUST PIPING

Heating System

FACTORY buildings are heated by direct radiation in the form of coils and cast-iron radiators as best suited to local conditions. The Webster system of circulation is employed, a pair of 6 by 10 by 12-in. single piston vacuum pumps being connected with the main return as shown in Fig. 8. These discharge into the receiving tank in the boiler room, and the condensation is pumped back to the boilers with the fresh feed.

Steam supply for the radiation has already been mentioned, coming principally through the bleeder connection from the main turbine, supplemented, when necessary, by live steam through a reducing valve.

The entire power and heating equipment for this plant, was designed by Hollis French and Allen Hubbard, of Boston, and is being installed under their direction.

CAST IRON CAN readily be soft soldered if the following instructions are followed. Make an amalgam of tin filings and mercury. What is not used at once can be kept in a wide-mouthed glass bottle for future jobs. The joint is first cleaned thoroughly, then a clean rag is dampened with commercial muriatic acid and some of the tin mercury amalgam is rubbed well into the cleaned joint. Soldering is then proceeded with in the usual way, using Yeager's soldering salts as a flux.—Exchange.

ELECTRIFICATION OF A PAPER MILL

How the Adoption of Electric Drive Improved Operating Conditions; Details of Installation; Saving Effected by New Arrangement

By S. A. Steage*

LOCATED ON A FAVORABLE WATER power site of Black River, one of the large water power streams of northern New York, and within the city of Watertown, are the Taggert Bros. Co's. mills. Paper of nearly all kinds is manufactured in this vicinity, ranging from newsprint paper; made largely from ground spruce wood and sulphite, to tissue papers, box board, wall papers and various kinds of super-calandered and highly finished fancy papers, made from wood, rags, burlap, jute, old ropes and large quantities of old newspapers.

In the Taggart mill old rope and similar raw material is manufactured into a strong firm paper and is made into flour and cement sacks.

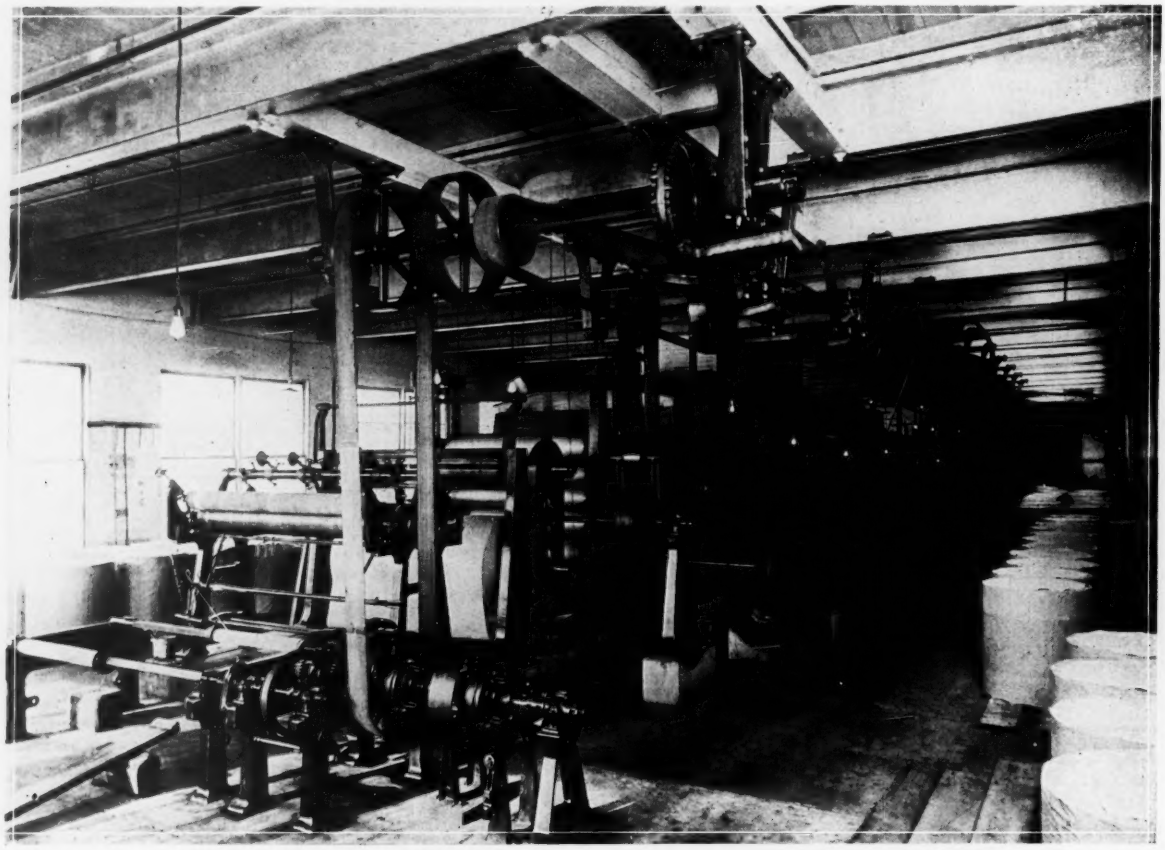

FIG. 1. BACK SIDE OF PAPER MACHINE SHOWING 40 HP. 240-720 R.P.M. VARIABLE SPEED D.C. MOTOR ON THE FLOOR AND 30 HP. CONSTANT SPEED D.C. IN REAR SUSPENDED FROM CEILING

There old ropes, formerly used for all sorts of purposes, are first of all sorted, cut up into short lengths, washed, cooked, brushed out into fine individual fibers in large beating engines, subjected to other special processes and treatments and then pumped into the screens. At this point, after being screened, the fine clean pulpy material passes onto the cylinder moulds at the "wet" end of the paper machine, where the process of forming the sheet is begun. From the revolving cylinder the pulp in a wet porous form is pressed against a felt between heavy rolls, where a large part of the water is pressed out and the pulp sheet is carried along on the felt between other heavy rolls where more water is pressed out and the sheet is made thinner and more firm. Later the sheet is carried onto the hot drying rolls, where practically all of the water is dried out. It is then carried through one or more "stacks" of smooth steel calander rollers and pressed with great pressure, giving to the finished sheet of paper a smooth hard surface.

This company for many years has operated 2 paper machines and a large number of beating engines and auxiliary equipment and apparatus necessary to the manufacture of this kind of paper and has derived its motive power entirely from the water power development at the mill.

At this point a dam extends across the river. A flume was constructed parallel to the main building and from this flume a number of vertical water wheels receive their supply and discharge into a tail race directly below the wheel pits.

At the opposite end of the dam other manufacturing

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industries also develop power. The head available at this site is normally 12 ft.

At a later date a large addition to the main building of the mill was constructed directly over the flume and in this new machine room was installed a larger and modern paper machine.

These 3 paper machines as well as all of the other machinery of the mill were driven by water wheels but none of the wheels have ever been provided with governors, and, inasmuch as there were some variations in the speed of the water wheels driving the paper machines, on account of slight variations in load and hydraulic disturbances, and perhaps to some extent on account of the characteristics of the wheels themselves, and also on account of the fact that for a considerable portion of the year it was not always possible to obtain sufficient water power to drive the full equipment of the mill, it was finally decided to drive the paper machines as well as some of the other smaller equipment by steam-electric power.

For the purpose of drying the paper and heating the mill a steam boiler plant had been installed and was used exclusively for this purpose without deriving any motive power therefrom.

After making an exhaustive investigation of the conditions it was decided that the boiler plant already in operation was of sufficient capacity to furnish steam for the driving of the 3 paper machines, lighting of the mill and for a number of the smaller machines and that it would be advisable to install a steam-electric unit and use electric-motor drive for the paper machines.

FIG. 2. FRONT SIDE OF PAPER MACHINE SHOWING CONTROLLERS FOR THE VARIABLE SPEED MOTOR, CONSTANT SPEED MOTOR AND 2 MOTORS IN BASEMENT DRIVING PUMPS AND AGITATORS

Inasmuch as each of the paper machines on account of the various kinds of paper manufactured, required a range of speed of 3 to 1, it was found that the most desirable method of drive would be to use a variable speed direct-current motor for the variable speed lines of each of the paper machines, with use of constant speed motors for the constant speed lines and for any other purposes required. Direct current throughout was decided to be the most practical for these conditions.

With a steam unit of a size necessary for the power requirements and a type most economical in steam consumption, consistent with price, it was found there would be sufficient exhaust steam to dry all of the paper manufactured and to heat the mill. Consequently it was decided to use a single cylinder non-condensing Corliss engine, direct connected to a continuous-current generator.

Formerly the variable speed for the paper machines had been obtained by means of a Moore & White drive. The back shaft with the taper pulleys, for driving the various sections of the machines, were located just below the roof over the paper machines, and it was found that the machines could be best driven by setting the motor on the machine room floor, belting to the back shaft for the variable speed drive; and for the constant-speed drives constant-speed motors were located at the most convenient position; controllers for the various motors were located in front of the machines, where they were within easy reach of the operators.

In addition to driving the paper machines there are a large number of printing presses also operated by motor drive, some with individual motors and others in group drives.

The boiler room contains two 72 in. by 18 ft. return tubular boilers designed for working pressure of 150 lb. gage and equipped with Murphy furnaces.

Practically all of the steam condensed from the

FIG. 3. PRESS ROOM SHOWING PRESSES WITH INDIVIDUAL MOTORS AND CUTLER HAMMER 3 TO 1, VARIABLE SPEED AND REVERSIBLE CONTROLLERS IMMEDIATELY IN FRONT OF OPERATOR, AND ALSO SUSPENDED FROM THE CEILING A CONSTANT SPEED MOTOR DRIVING LINE SHAFT AND ANOTHER GROUP OF PRINTING PRESSES

paper machine dryers and heating coils of the mill is returned to a receiving tank and is used again for boiler feed, being returned to the boiler room at nearly 212 deg. F. After sufficient additional water has been supplied to make up for losses, the water is pumped to the boilers by means of a duplex steam pump.

To accommodate the new engine-generating equipment a reinforced concrete engine room was built adjoining the boiler room and immediately at the north end of the main building of the mill, of sufficient size to accommodate the present steam equipment and also with sufficient floor space, and arranged to receive a 750-kw. water wheel type generator which it is anticipated will at a later date be installed, direct connected to a horizontal multiplex hydraulic turbine unit in the flume under the main building and adjoining the power house so that the mill wall and the power house wall will form a bulkhead between the wheel pit and generator room.

In the new engine room was installed a 16 by 30 in. 150 r.p.m. noncondensing Corliss engine direct connected to a 175-kw. 240-volt direct-current generator; a 3-panel switchboard for generator balancer set and distribution system; and a 5-kw. 3-wire balancer set to take care of the 110-220 volt 3-wire lighting system.

Direct-current at 220 volts is used for all of the motors. Speed variations for the paper machine and printing press motors is obtained exclusively by field control and the speeds of the motors have been found to

be exceedingly constant and uniform. The engine, generator, switchboard and all of the motors for the paper machine drives were furnished by the Allis-Chalmers Company, the boilers by the New York Engine Company and the stokers by the Murphy Iron Works.

A vacuum drying system was designed for operation in connection with the paper machine dryers and was also used in connection with the heating system of the mill, which greatly decreased the amount of steam required and together with the greater uniformity in the speed of the paper machines has resulted in the production of a much more uniform and better grade of paper; and the power actually required to drive the machines with the electric drive is not more than one-half of the power apparently used before, according to the rating of the water wheels and water used.

With this system of machine drive, when a change in speed of the paper is desired, it is only necessary to move the controller handle forward or backward until the speed is increased or decreased as desired. To adjust the "Draw" of the paper the individual belts on the taper pulleys are shifted in the ordinary way.

The printing presses which formerly received their power through jack shafts, numerous belts, long line shafts and gears and eventually from the water wheels, are now driven by individual variable-speed motors or small group drives, which are easily and at all times under full control of the operator and can be run at the most efficient speed for the kind of work being done.

These presses are used for printing the trade marks, brands and names of the manufacturers of flour, cement, etc., who will use the sacks.

This change in method of drive and source of power has not only resulted in far better quality of production but the actual fuel consumption for operating the entire steam electrical plant developing some 250 electrical horsepower is no more than the fuel consumption previously required for drying the paper, and heating the mill with live steam without producing any motive power; and some 400-hp. water is left available for driving beaters and other equipment, which was formerly used by the water wheels driving machinery now operated by electric motors.

RECORD FORMS OF A PLANT

Actual Readings and Forms Used in Keeping a Small Station Record of Performance

By C. E. Nigh

BEING interested in the articles on Power Plant Records, and the forms of records which have been appearing from time to time the writer desires to submit to the readers of Practical Engineer the daily station records of a modern little plant in W. Va.

Figure 1 is an actual record of station operation on Jan. 8, 1912. In the upper left hand part is given the hours of operation of any unit in the plant. Upper right gives the D. C. maximum Amp's. and recording watt meter readings, the total D C output is recorded on the loop meter, and the Sab. Ry. meter records the current supplied to a separate trolley circuit and is not added to the readings of the loop. Two other trolley circuits are supplied with current from the loop also, their meters being hung on poles near the place of connection.

Next comes the names of the station crew and their hours shift. Then comes the hourly readings of the A. C. recording watt meters. Nos. 1 and 2, are on the street lighting circuits and are read only while the lights are on. Nos. 3 and 4 are temporarily out of commission due to the removal of 2 single phase oil switches and replacing same with 2 phase oil circuit breakers. All electric meters are read every hour, the last 2 columns giving the total kw.-hr. output and the indicated kw. load.

Next comes the gas meter, water meter, gas pressure (at the burners), feed water temperature and stack temperature. These readings are taken every 6 hours. A record of all oils, grease, waste, etc., are kept, and last a place for general remarks such as repairs, renewals, troubles, etc.

Figure 2 is made up from Fig. 1 and is sent to the office daily. The A. C. capacity, indicated watt meter, and kw.-hr. load curves are plotted in the upper left hand corner, beneath this a curve is drawn showing the time of operation of any unit, or feeder circuit.

In upper right hand corner are ploted the D. C. capacity, maximum amperes, and kw.-hr. curves. Beneath this the name and shift of the crew, and beneath this the 24 hr. meter readings which are taken at 1 a. m., and from which the total consumption of gas, water and electric output is computed. All water used in the plant is metered in gal. by the meter but is reduced to pounds for final computation.

In upper center the oil account, etc., is kept. Also the condenser performance of an exhaust steam turbine, these readings are also taken every 6 hr. and the average given herewith. The lower center is given to space

Giving lbs. of water per cu. ft. of gas.
" cu. ft. of gas per kw.-hr.
" lbs. of water per kw.-hr.
" kw.-hr. per hr, labor.
" A. C. load factor per cent.
" D. C. load factor per cent.

The time consumed in making up these reports is well spent as the auditor in the office can quickly compute the cost of operation. A monthly report is also made up for the office of all consumption and outputs. This plan of plant records has been in use in this plant for several years and has been more satisfactory than any we have yet noticed. It is the writers plan to make these more complete so as to give the cost of labor, supplies and station operating cost at a glance.

These records are kept on file and it is a very easy matter to refer to any previous date for information in regard to station operation.

Do not think from the accompanying illustrations that the keeping of the records involves complications. When the system is once established it only requires a few minutes, or perhaps seconds, at a time to maintain a log that will be comprehensive in every respect.

It is gratifying to be able to look back over a period of six months or a year and be able to figure at a glance just the amount that it has cost for repairs on every piece of machinery, including what the labor charges have been, the extra parts, etc. From the records it can at once be determined whether any piece of apparatus should be replaced in order to increase economical operation.

If this article helps some plant owner or brother engineer the writer's object will be fulfilled or he will give any information he can to those who desire it.

UNION UTILITIES CO. — ELECTRIC DEPARTMENT

DAILY STATION RECORD.

DATE Monday - Jan 8 1912

Boiler No. 1	From 1 AM.	to 1 AM	24
Boiler No. 2	" 1 "	" 1 "	24
Boiler No. 3	" 1 "	" 1 "	24
Boiler No. 4	" 1 "	" 1 "	24
Feed Pump No. 1	" 1 "	" 1 "	24
Feed Pump No. 2	" 1 "	" 2 30 PM	13½
W. W. Pump	" 3 P.M.	1 AM	10
Air Comp.	" 1 15 AM.	" 2 30 Am.	11¼
Feed Water Heater	" 1 AM.	" 1 AM.	24
Fan Engine	"	"	
No. 1 A. C. Set	" 5 45 AM	" 10 30 P.M.	16¾
No. 2 A. C. "	" 1 AM	" 1 AM	2.4
No. 3 A. C. "	" 1 "	" 1 "	24
No. 1 D. C. "	" 4 45 AM	" 1 A.M.	20¼
No. 2 D. C. "	" 3 30 "	" 11 30 P.M.	18.
Motor Gen. "	"	"	
No. 1 Exc. "	"	"	
No. 2 Exc. "	" 5 45 AM	" 10 30 P.M.	16¾
No. 3 Exc. "	" 1 AM.	" 1 AM	24
H. T. Pwr. Cir.	" 1 AM.	" 1 A.M.	24
D. C. Pwr. Cir.	" 5 A.M.	" 7 P.M.	12
Arc Circuit Off	" 6 30 AM	on 5 45 PM	12¾
Inc. Cir. No. 1 "	" 6 30 "	" 5 45 "	12¾
Inc. Cir. No. 2 "	" 6 30 "	" 5 45 "	12¾

HOURLY METER READINGS D. C.

Time	Max Amp	Sub. Sy.	K. W.	Loop	Net	eff.	K. W.	Total K. W.
1 A. M.	350	295400	25	5678540	70	.6	42	42
2 "								
3 "								
4 "								
5 "								
6 "	400	295400	25	5678740	150	.6	90	90
7 "	750	" 500	25	5679030	290	.6	174	174
8 "	850	" 500	50	" 290	260	.6	156	156
9 "	925	" 600	50	" 670	380	.6	228	228
10 "	900	" 600	25	" 940	270	.6	162	162
11 "	875	" 600	25	5680200	260	.6	156	156
12 M.	900	" 600	25	" 550	350	.6	210	210
1 P. M.	800	" 700	25	" 850	300	.6	180	180
2 "	1000	" 700	25	5681150	300	.6	180	180
3 "	975	" 700	25	" 480	330	.6	198	198
4 "	875	" 700	25	" 800	320	.6	192	192
5 "	975	" 800	25	5682150	350	.6	210	210
6 "	950	295800	30	" 500	350	.6	210	210
7 "	875	" 800	30	" 800	300	.6	180	180
8 "	825	" 900	40	5683070	270	.6	162	162
9 "	775	" 900	25	" 350	280	.6	168	168
10 "	725	" 900	25	" 610	260	.6	156	156
11 "	675	" 900	25	" 930	220	.6	132	132
12 "	500	296000	25	" 990	160	.6	96	96
Totals			600				3288	

Engineer	Name	From 7 A.m.	To 5 P.m.	10
"	"	" 1 P.m.	" 10 P.m.	9
"	"	" 10 P.m.	" 7 A.m.	9
Oiler	"	" 6 A.m.	" 5 P.m.	11
Fireman	"	" 1 A.m.	" 1 P.m.	12
" "	"	" 1 P.m.	" 1 A.m.	12
" "		"	"	63

HOURLY METER READINGS A. C.

Time	No. 1	K. W.	No. 2	K. W.	No. 3	K. W.	No. 4	K. W.	No. 5	K. W.	No. 6	K. W.	No. 7	K. W.	Total K. W.	Ind. W.
1 A. M.	249010	20	333010	20					1200600	50	19190	190			260	340
2 "	" 30	20	" 20	10					" 650	50	" 380	190			270	325
3 "	" 50	20	" 40	20					" 725	75	" 560	180			295	325
4 "	" 70	20	" 50	10					" 800	75	" 740	180			285	300
5 "	" 80	10	" 70	20					" 850	50	" 930	190			270	310
6 "	249100	20	333080	10					1200900	50	20110	180			260	275
7 "									1201200	300	" 310	200			500	650
8 "									" 550	350	" 580	270			620	780
9 "									" 900	350	" 860	280			630	725
10 "									1202200	300	21100	240			540	650
11 "									" 450	250	" 370	270			520	600
12 M.									" 750	300	" 600	230			530	625
1 P. M.									1203050	300	" 810	210			510	600
2 "									" 350	300	22050	240			540	610
3 "									" 700	350	" 300	250			600	680
4 "									1204000	300	" 560	260			560	650
5 "									" 300	300	" 850	240			590	640
6 "	249110	10	333090	10					" 500	200	23160	310			530	600
7 "	" 120	10	" 100	10					" 550	50	" 470	310			380	440
8 "	" 140	20	" 120	20					" 600	50	" 800	330			420	450
9 "	" 160	20	" 140	20					" 650	50	23120	320			410	450
10 "	" 180	20	" 160	20					" 700	50	" 420	300			390	425
11 "	" 200	20	" 170	10					" 750	50	" 670	250			330	370
12 MN.	" 220	20	" 190	20					" 800	50	" 890	220			310	325
Totals		230		200						4250		5890				

Gas Meter	Water Meter	Gas Pressure	Feed Water Temp. F	Stack F Temp.	Lbs. Coal	Lbs. Ash		
563868300.	72719500	2½	210°	460°			Total A. C. K. W.	10570
66110 Cu ft	80300 gal.						Total D. C. K. W.	3288
							Total K. W. Output	13.858

Crankcase Oil Gal.	7 gal. Used.
Cylinder " "	1 " "
Engine " "	
Turbine " "	
Grease Lbs.	
Waste "	
Boiler Comp "	Soda-Ash 5 Lbs.

REMARKS: Inspected No 4 Boiler for cleaning and repairs. Placed new gaskets in leaky unions on gas burners. Inspected blow off valve disc. on No 4 boiler. Changed location of air tank and run newer air line to engine room.

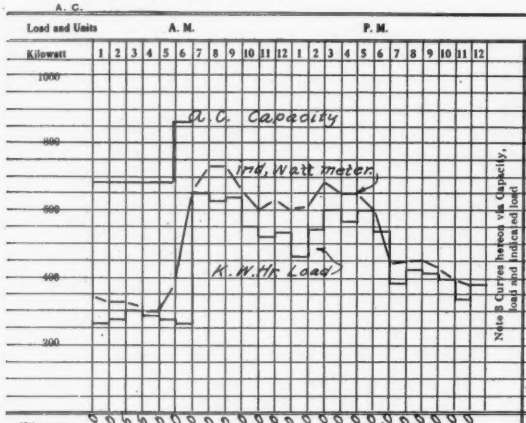
FIG. 1. DAILY READINGS FROM WHICH CURVES ARE PLOTTED

DAILY STATION LOG

UNION UTILITIES COMPANY

MORGANTOWN, W. VA. BEGINNING 1 A. M. Monday Jan 8, 1912.

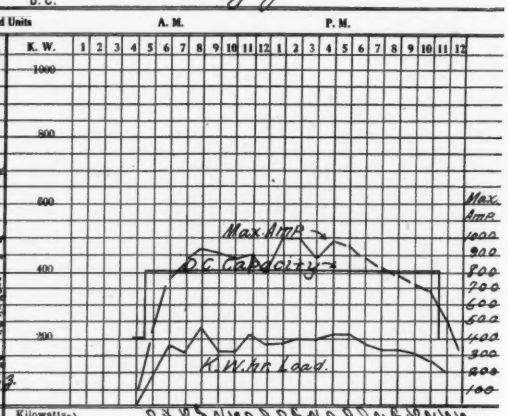
A. C. Load and Units — A. M. / P. M. — Kilowatt



Kilowatts Per Hr.	260	270	265	275	270	260	600	620	630	645	625	610	570	540	600	550	590	530	345	420	410	390	350	370

OILS, Etc.	Gal.
Crank Case Oil	7
Cylinder Oil	1
Engine Oil	
Turbine Oil	
Cup Grease	
Waste	
Boiler Comp.	
Soda Ash.	5#
Cond. Performance	
Av. Steam Pres.	2#
" Vacuum	28"
" Cond. Temp.	30°
" Inj. "	33°
" Disc. "	58°
" Steam "	210°
" F. Water Temp.	210°
" Gas Pres.	2½
" Air "	

D. C. Load and Units — A. M. / P. M. — K. W.



Kilowatts Per hr.	42	90	174	156	221	162	160	210	170	180	185	192	210	210	170	162	165	156	152	96	106

STATION APPARATUS IN OPERATION

No. & Rating		Hrs
	Generators	
1—A. C. 180		16¾
2— " 180		24
3— " 500		24
4— "		
1—D. C. 200		20¼
2— " 200		18
3—		
	Exciters	
1—Exc. 5-6		
2— " 5.6		16¾
3— " 15		24
	Motor Generators	
1—180		
2—		
3—		
	Compressor Motors	
1—		1¼
2—		
	Electric Service	
1—Arc. Clr		12¾
2— "		
1—Inc. "		12¾
2— " "		12¾
3— "		
1—Comcl. "		24
2— " "		24
3— "		
4— "		
1—A. C. Pwr.		24
2— " "		
3— " "		
4— " "		
1—D. C. "		14
2— " "		
	D. C. Railway	
U. U. Ry.		20¼
Sabraton Ry.		20¼
M. & P. Ry.		20¼
So. Mgt. Ry.		20¼
M. & D. V. Ry		20¼
	Boilers	
1—300 H. P.		24
2— " "		24
3— " "		24
4— " "		
1—F. P.		24
2— "		
3— "		
1—F. W. H.		24
2— " "		
1—Fan Eng.		
2— " "		
1—Water P.		23½
2—Water P.		

OPERATING CREW

A. M. / P. M.

	Name	Hrs.
Engrs.	"	10
	"	9
	"	9
Oilers	"	11
Firemen	"	12
	"	12
Helpers		
		63

24 Hour Meter Readings taken at 1 A. M.

Supplies Received	Meters	Beginning	Ending	Net	Cons'l	K. W. Hrs.
	Con. C. Trans. A	249010	249240	230		230
	" " " B	333010	333210	200		200
	" "					
	No. 1—H. T.	1200600	1204850	4250		4250
	No. 2— "					
	No. 3— "					
	Comc. Cir. A					
	" " B					
	" " C.D.	19190	25080	5890		5890
	Loop + Feeders	5678590	5684070	5480	.6	3288
Supplies used in Repairs, etc.	Sub. Ry.	295400	296000	600		
	Total A. C.					10570
	Total D. C.					3288
	Total K. W. Del.					13858
Lbs. Water Per Cu.ft. gas 1.01	Water Meter	727195	727998	803	833	668899 Lbs.
Cu.ft. gas Per K. W. hr. 47.7	Gas "	5638683	5645294	6611	100	661100 Cu.ft.
Lbs. Water Per K. W. hr. 48.3						
K. W. hrs. Per hrs. Labor 220						
A. C. Load Factor % 646						
D. C. " " 429	Coal					

REMARKS

Inspected No. 4 boiler for cleaning & repairs
Placed new gaskets in leaky unions on gas burners. Inspected blow off valve disc. on No 4 boiler. Changed location of air tank, and run new air line to engine room.

FIG. 2. DAILY REPORT SENT TO OFFICE

EUROPEAN POWER PLANT PRACTICE

Tar Oil As a Fuel for Diesel Engines

By Francis G. Wickware

FIVE years ago the manufacture of Diesel engines in Germany was thrown open to competition through the expiration of Dr. Diesel's fundamental patents. Many firms immediatedw began the manufacture of oil motors of the Diesel type and the rivalry among them has had the usual large effect on the development of the Diesel engine.

One of the most important directions in which this development has proceeded has been in the adaptation of the motor to operation on fuels other than crude oil or its derivatives. Germany has no petroleum deposits, and fundamentally the problem of securing the position of the Diesel motor in competition with steam and gas engines was one of discovering reliable supplies of cheap fuel of domestic origin.

The recent successful experiments with gas-works tar have already been described in Practical Engineer. These followed logically upon the adaptation of the Diesel motor to operation on tar oil, the possibilities of which were recognized long before the stress of competition led to its practical application as a fuel.

Tar oil is produced in Germany in quantities largely in excess of ordinary demands, and while its use in Diesel engines is not now very extensive, yet the annual consumption for power purposes is some thousands of tons. The fuel is rapidly gaining in popularity, and a recent writer in Gluckauf predicts a consumption this year of 20,000 to 30,000 tons.

Qualities demanded of tar oil for use in Diesel engines are these: It must not contain more than 0.2 per cent xylene, more than 0.05 per cent incombustible matter, or more than 1 per cent water. At least 60 per cent by volume must be volatile at 572 deg. F., and the oil must be fluid at 59 deg. F., while the flash point must not be lower than 149 deg. F.

The largest unit yet built for operation on tar oil developes 4000 hp. while units of 600 to 800 hp. are common. Above this limit of power tar oil engines are exclusively of the horizontal type; below they may be either vertical or horizontal. Engines up to 600 to 800 hp. have 1 to 4 cylinders on a single crankshaft. The lower limit of power for tar-oil engines is 50 hp., below which they are not efficient.

As in operation on tar, a certain amount of a lighter oil is required, in most cases, to promote ignition. Paraffin oil or kerosene is commonly used, in amount 5 to 10 per cent of the tar oil, though recently the proposal has been made to use benzal. The manufacturers are now trying to devise means of avoiding the use of ignition oil except for starting. One is experimenting with very high compression; another is trying the effect of preheating the fuel by means of the waste gases or the jacket water. In all cases, of course, it is possible to run temporarily on tar oil alone under favorable working conditions. With the ignition oil, however, all difficulties of operation are entirely removed. Ignitions are regular, there is little variation of pressure, and the engine adjusts itself to changes of load with steadiness and reliability.

As to the general reliability of the tar-oil motor, the makers guarantee it to be as high as that of the best steam engines, with no higher maintenance charges. In the many plants operating units of 50 to 1600 hp., the valves and pistons have given no trouble when properly cared for, and the wear is very small. On account of the fact that it is impossible to eliminate sulphur from the fuel, however, the parts which come in contact with the oil have to be made of special materials. The use of copper-zinc alloys is forbidden; hence, the parts usually made of brass or phosphor bronze are made of pure nickel or 25 per cent nickel steel.

The consumption of fuel is constant over long periods of operation and the economy under varying load is very favorable. The results of 3 months' operation of a 200-hp. motor are given in the paper under review. In 780 working hours, 86,470 kw.hr. were developed with a total fuel consumption of 32.56 tons. The average consumption per kilowatt-hour was, therefore, 0.755 lb., or per horsepower-hour, 0.482 lb.

At the prevailing market price of tar oil, $9 per ton, the fuel cost per horsepower-hour was 0.22 cent. During the period the motor was subjected to sudden and considerable changes of load, at times reaching 20 per cent overload, though the average was considerably under rated load. The consumption of lubricant was small, about 0.18 gal. per hour. Similar results have been obtained in tests of a 60-hp. motor in the works of the Gasmotorenfabrik Deutz. Taking the cost of tar oil at $9 per ton and of gasoline for ignition at $22.50 per ton, the fuel cost per horsepower-hour worked out as follows: At full load, 0.22 cent; at ¾ load, 0.24 cent; at ½ load, 0.27 cent; and at ¼ load, 0.37 cent.

Including all accessories, the cost of a 120 hp. tar oil motor installed is about $7500, and of a 440-hp. unit $18,750. A careful estimate of the first and operating costs of 120, 440 and 1000 hp. units is as follows:

	1000 hp.	440 hp.	120 hp.
First cost	$37,500	$18,125	$7,250
Annual operating cost:			
3000 hours per year	$12,050	$ 6,000	$2,315
8600 hours per year	$26,325	$12,325	$4,475
Operating cost per hp.-hour, cents:			
3000 hours per year	0.4	0.45	0.64
8600 hours per year	0.3	0.32	0.44
Fuel cost per hp.-hour, cents:			
3000 hours per year	0.23	0.23	0.23
86000 hours per year	0.23	0.23	0.23

Researches of the Geological Survey continue to unearth coal supplies in different parts of the country. In Arizona promising fields have been discovered, one containing about 6000 square miles in the Black Mesa of the Hopi Indian Reservation. The other at Deer Creek containing some 30 square miles in the middle of the copper producing region. It is estimated that the Black Mesa fields contain some 8,000,000,000 tons which are discovered; and the Deer Creek fields contain about 60,000,000 tons which are discovered. One grade of coal is a hard coal and can be used for coking, the other is a soft coal which crushes easily and has a high percentage of ash. It can be used only for local consumption or can be converted into gas, as it has a high volatile which might be pumped to other localities.

Electrical Machinery and Appliances

For Generating, Transmitting and Using Current

SYNCHRONIZING ALTERNATORS

Comparison of Direct Current and Alternating Current Operation; Synchronizing With Lamps Light and Dark; Synchroscopes and Synchronism Indicators

By V. E. JOHNSON

MANY engineers have trouble in understanding the principles of synchronizing. This is perhaps due to one thing more than to any other, and that is, that the mind is unable to grasp clearly the idea of alternating current; not from the fact that the current periodically reverses its direction of flow, but rather from the fact that these reversals occur with almost inconceivable rapidity.

It is simple enough to think of, and understand the action of an e.m.f. reversing, say once an hour—and as paralleling at such a frequency is analogous to synchronizing in actual practice, I shall try the occasional assumption of such a low periodicity to explain concretely the bringing into step of 2 alternating electromotive forces.

If we are to parallel 2 shunt-wound d.c. generators we must have the machine:

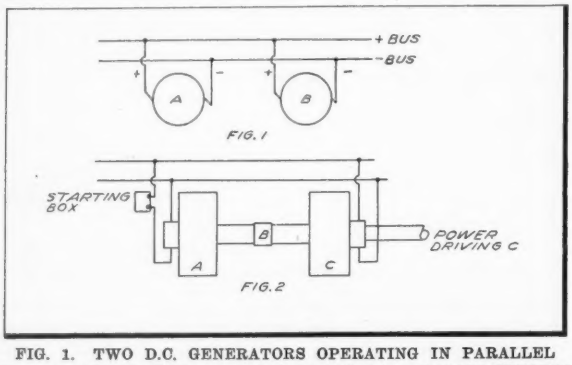


FIG. 1. TWO D.C. GENERATORS OPERATING IN PARALLEL
FIG. 2. DIRECT-CURRENT MOTOR DRIVING A DIRECT-CURRENT GENERATOR

(a) Generating equal voltages; (b) the + busbar must be connected to the + machine lead; the — busbar to the — machine lead.

These 2 requirements are well understood so that the accompanying diagram Fig. 1, needs no explanation.

Assume that the 2 machines are thrown together with these conditions unfulfilled. If the machines are not of the same voltage, for example if A has 210 and B 212 volts, B sends current through A causing it to run as a motor and increase its speed enough to make its e.m.f. equal to that of B. This becomes quite plain if we remember that a generator and a motor are exactly identical.

Return to the 2 generators in parallel, A and B Fig. 1. If we throw the belt off A it will still continue to rotate, not doing any useful work, but merely acting as a load on B. Or, suppose there is a combination as in Fig. 2. If we start A as a motor and after bringing it up to speed throw in the clutch B, we will have A operating as a generator in parallel with C.

To carry out further the reasoning so as to make this interchangeability a concrete fact rather than an abstract idea, take the case in Fig. 3 where we have 2 motors driving 2 generators. If any one of the 4 fields are weakened that machine will tend to have a lower e.m.f. (It can not actually have a lower voltage if the connecting lines are of negligible resistance, which is analogous to the fact that 2 tanks of water connected by a pipe would have the water level at the same height.) If we weaken the field of Ma it takes more current from buses M and Ga delivers more current into busbars G. If we weaken the field of Gb it runs as a motor driving Mb as a generator "pumping back" into the busbars M. If the voltage of the M busbars drops so as to tend to slow down the combination both Ga and Gb will take current from the G busbars, driving Ma and Mb as generators and so tending to maintain the voltage in busbars M.

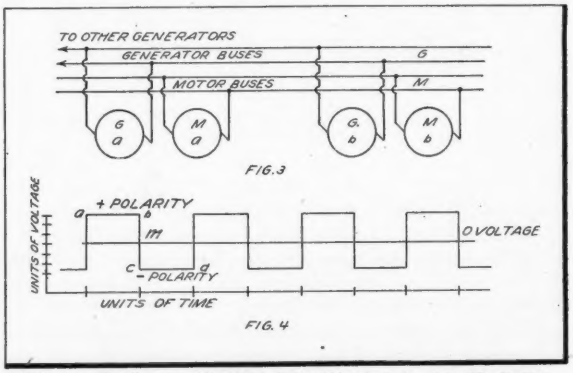


FIG. 3. TWO D.C. MOTORS DRIVING 2 D.C. GENERATORS
FIG. 4. GRAPHIC ILLUSTRATION OF ALTERNATING CURRENT

When paralleling d.c. generators, if one of the machines is generating a little higher e.m.f. than the other, nothing serious takes place. The greater difference there is, the greater will be the rush of current. With machines having nearly the same voltage the only possibility is, that if the running machine is already heavily loaded the extra current due to the incoming generator running as a motor may cause the circuit breaker to open and so interrupt the service.

If similar polarity is not maintained the action will be as follows: The 2 generators are now in series, and so adding their e.m.f. there is no resistance on

circuit except that of the 2 armatures and the connecting lines, resulting in a short circuit of sufficient magnitude to do serious damage before the breakers have time to open.

Keeping the foregoing discourse in mind let us take up the case of 2 alternating e.m.f.'s. We can think of these as being direct e.m.f.'s periodically reversed. Fig. 4 illustrates how such a wave would appear—plotting time and voltage as shown.

It is not essential to the discussion whether the time units are hours or hundredths of seconds. From a to b during one time unit we have a direct e.m.f. which at the point M reverses and becomes an e.m.f. of opposite polarity, lasting one time unit from c to d —when it again reverses.

If the e.m.f. was to be paralleled with one similar to it, 2 conditions would have to be fulfilled exactly as in the case of the d.c. shunt generators already discussed, that is, at the instant of closing the switch the 2 e.m.f.'s must be equal and of the same polarity. This brings into consideration a new element, that of frequency; the distance measured in time units between reversals must be the cause in both machines. If this is not true and the waves are of different lengths, measured in time units, they will periodically be of the same polarity and be periodically in opposition. If 2 e.m.f.'s of different frequency be connected in parallel they may for an instant remain in step and then due to the unequal wave lengths be in opposition. Thus from the 2 requirements for d.c. machines

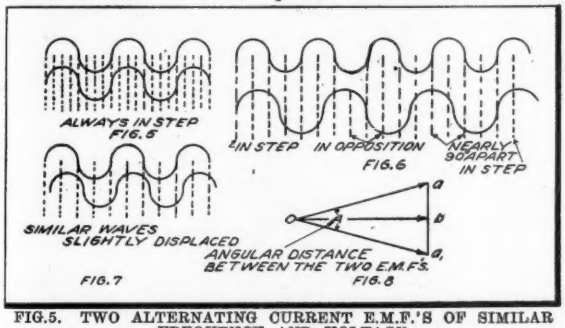


FIG. 5. TWO ALTERNATING CURRENT E.M.F.'S OF SIMILAR FREQUENCY AND VOLTAGE
FIG 6. TWO E.M.F.'S OF DISSIMILAR FREQUENCIES
FIG. 7. SIMILAR WAVES SLIGHTLY DISPLACED
FIG 8. GRAPHIC ILLUSTRATION OF THE RELATION OF VOLTAGES

a third one is evolved when we are dealing with a.c. machinery and that is similarity of frequency.

Figure 5 illustrates how 2 e.m.f.'s of similar frequency and voltage would remain in step, both reversing at the same time. Fig. 6 illustrates how 2 e.m.f.'s of dissimilar frequencies would drop out of step after a time due to the fact that the reversals would not occur simultaneously and also shows how they would be periodically in step.

Assume now, as we did in the previous case, that the machines are thrown together with any of these conditions not fulfilled. If the machines have different voltages there will be a tendency toward a potential difference at every part of the waves except where they cross the zero line of the potential. The result is that the machine of higher voltage sends current through the machine with the lower voltage.

In this case the cross current lags behind the e.m.f. of the machine with the higher field excitation, and leads the e.m.f. of the machine with the lower field excitation. Without explaining further, it may be said that a lagging current in an alternator demagnetizes the fields and lowers the voltage while a leading current strengthens the field and raises the voltage. So in our case the machine with the higher voltage has its voltage lowered and the one with the lower voltage has it raised until equilibrium is reached at a point where the cross e.m.f. is sufficient to send enough cross current through the machines to react on the fields and so equalize the voltage.

When similar polarity is not maintained it results in a short circuit of double voltage through the 2 armatures exactly as in the previous case of the d.c. generators. In a machine with a low frequency, such as in the illustrative case, this would have serious consequences, but at commercial frequencies the impedance of the armatures is generally great enough to prevent any destructive surge of current.

A subdivision of the above case is one where the machine switch is closed before the waves exactly coincide. Fig. 7 illustrates such a case. There is an interchange of cross current, due to the instantaneous potential differences in the waves, which tend to pull the machines together. In the case of generators driven by elastic prime movers, such as steam engines, turbines and d.c. motors, the leading machine is drawn back and the following machine forward until the waves coincide. With a reasonable difference in wave relations no harm is done. If the prime movers are not elastic, such as synchronous motors locked in step, dropping into step can not occur, but the machines will continue out of sychronism—exchanging cross current. Under this condition the voltage at the busbars is lower than that of either machine.

Figure 8 shows graphically by means of vectors the relations of the voltages: oa and oa_1 are the machine voltages while ob is the resultant busbar voltage; aa_1 is the cross e.m.f. By inspection it will be seen that ob = oa cos ½A where A is the angular difference between the two e.m.f.'s, also aa_1=2 ob sin ½A.

If similar frequency is not maintained one of 2 things will happen; if the prime movers are elastic the interchange of current will cause the frequencies to become the same and lock the 2 e.m.f.'s together in synchronism, unless the difference in wave length is large. With nonelastic prime movers, the generators will not hold in step, as an instant will be reached where the e.m.f.'s are in opposition. See Fig. 6.

(To be continued.)

ON THE ASSUMPTION that there are in the United States, exclusive of Alaska, 139,855 square miles of swamp lands, it is estimated by the Bureau of Mines that 8 per cent of this area, or 11,188 square miles, will have peat deposits of good quality. Assuming further that the average depth of the peat in this area is at least 9 ft., and that the average yield will be 200 tons of salable fuel per acre for each foot of depth, the total available fuel in these deposits will reach 12,888,500,000 tons; this quantity, if converted into machine-peat bricks and sold at $3 per ton, would have a value of $38,665,-700,000—no mean resource, but one that would furnish heat and power for the entire country for many years.

Comparing the cost of peat fuel with that of coal, the former could be produced with less danger and with a much less expensive equipment if it needed only to be dug, because it lies at or just below the surface of the ground. A readily marketable type of peat fuel, in the form of air-dried, slightly compressed blocks, can probably be produced at an expense of from $0.75 to $1.25 or $1.50 per ton, and with properly devised and properly arranged machinery, production on a large scale would considerably lower the higher price for peat of well-decomposed types.

PECULIAR GENERATOR TROUBLE

By Ellis G. King

SEVERAL years ago the writer happened to be in a small town located on one of our navigable streams and desiring to get back to headquarters decided to take a boat which was due to arrive before the next train. After a short time, the trip beginning to wear upon me, I decided to go below and make the acquaintance of the engineer, which I did. We soon became on good terms and he showed me over the place making comments on the particular types and the characteristics of the various pieces of machinery in his care.

I noticed particularly his lighting outfit and stepping up to his board called his attention to the fact that his voltage was down to about ninety. He told me that he was never able to hold his voltage when the pilot put the search light on and in way of demonstration stepped up to the rheostat and turned all the resistance out. The voltage did not change perceptibly and thinking this strange I began to look around with a view of determining just what was wrong. I stepped over to the generator, a small 110-volt d.c. machine, and gave it a casual examination, but could find nothing at all unusual in its performance; it was running cool and without sparking.

It then occurred to me that possibly several sections of the resistance in the rheostat were shunted out in some manner and I suggested this possibility to him only to be told that he had had it apart and found it alright. Taking hold of the rheostat handle myself I moved it back and forth and found that the voltage attained a maximum when about two-thirds of the resistance was out, any further movement having no effect whatever on the pointer of the instrument. I noted, however, a difference in the tone of the machine while manipulating the rheostat and in order to account for it stepped over to the engine and the difficulty was explained at once.

I found that the engine had no governor, the old one having been discarded previous to the advent of the present engineer and in addition to this the steam pipe had been reduced in size at the first bend above the cylinder causing wire drawing. The engine was governed by the throttle and I might add by the rheostat to some extent the action being as follows:

The engine when started was given steam for the load then called for and the voltage set at 110 volts. When the load came on the engine slowed down and the voltage dropped to 90. Any adjustment of the rheostat altered the engines speed without changing the voltage. The tendency in cutting out the resistance being to raise the voltage thus adding to the load and slowing down the prime mover.

Should you attempt to lower the voltage the reduced voltage and consequently reduced load would cause the engine to speed up and the extra speed given to the generator in this case almost exactly compensating for the additional resistance introduced into the shunt field circuit.

The Quincy Market, Cold Storage & Warehouse Co. is having a 1000-ton refrigerating machine built from the remodeled Pennsylvania Iron Works Co. patterns. This machine will have 3 vertical single-acting compressors, each of the Voorhees multiple effect type. It will be installed at the Sargent Wharf Power Station of the company, at 60 Eastern avenue, Boston. When erected this will be the largest single refrigerating machine in the world.—Cold Storage and Ice Trade Journal.

INCORRECT METER CONNECTIONS

ATTENTION is directed to a mistake in connecting meters in connection with a transformer test that resulted disastrously to 2 wattmeters, and but for great good fortune would have cost the man in charge of the test his eyesight.

The core loss of a 3-phase 11,000 volt transformer was required to be checked, and after balancing up the currents on the 3-phases, the tester connected in a wattmeter (A), as shown in the sketch, to read the input

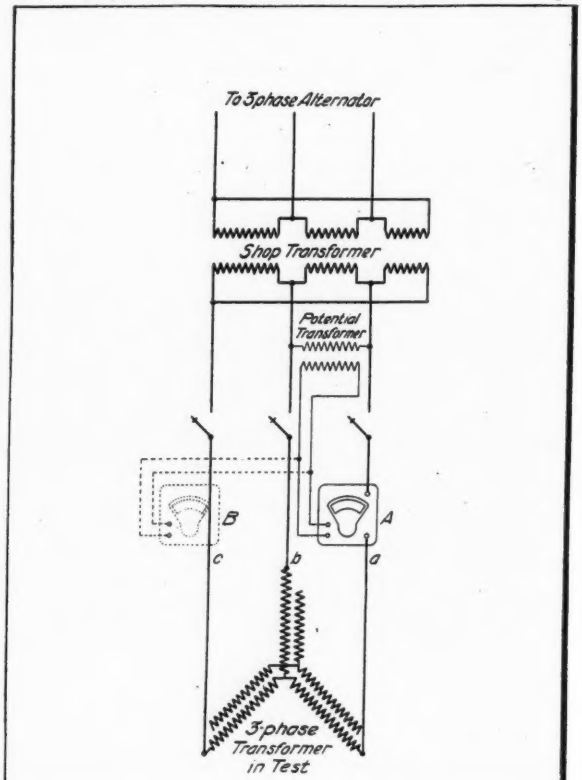


DIAGRAM SHOWING INCORRECT METER CONNECTIONS

on one phase; presumably intending to multiply the reading of this meter by $\sqrt{3}$ to obtain the total core loss of the transformer. This, of course, is not the correct method of taking wattmeter readings on 3-phase work, and as soon as the foreman in charge became aware of what was going on, he gave instructions to the man conducting the test to connect in a second wattmeter. This the tester did, opening up the outside lead for the current coil of the wattmeter (B) and connecting the potential coil to the potential transformer employed for the first wattmeter. In doing this a second mistake was made, more serious in its consequences than the first; for not only would the connections as made not give the proper readings on the wattmeter because of the incorrect phase relations between voltage and current, but as soon as the tester attempted to bring up the voltage of the transformer, there occurred a volcanic eruption through the cases of the wattmeters, directly in the face of the tester, that completely destroyed the instruments and so unnerved the tester that he was unable to continue with the work.

An inspection of the diagram will show that the insulation between the 2 coils of the wattmeter was all that separated the 2 phases in which the wattmeters were connected. On low voltage instruments this resistance, of course, is not intended to withstand high pressure and consequently broke down, short circuiting the phases and doing the damage already mentioned.—General Electric Review.

CARTERCAR TRANSMISSION GEAR

Friction Transmission Giving Unlimited Speeds; Single Chain from Friction Wheel to Jackshaft; Double Chain from Jackshaft to Rear Wheels Are Some of the Features

TRANSMISSION gearing is the part of an automobile's mechanism which transmits the power of the motor to the driving wheels. It is a combination of parts arranged in such a way that by means of a suitable lever, different gear ratios or speed ratios may be obtained.

Such is the construction of a gasoline motor that its power depends largely upon its speed, therefore, for heavy duty the ratio of gearing to the driving wheels must be raised to increase the power.

Cartercar Transmission

THERE are several different kinds of transmission, the most common being the sliding gear transmission. In this device rows of gears are arranged on parallel shafts, and speed changes are made by sliding different gears into mesh with one another while turning at high speed.

Cartercar employs friction transmission instead of a gear box containing a number of toothed gears or cogwheels. Power is transmitted by friction, by a rolling contact of one round disk against another placed perpendicular to it, as shown in the accompanying illustration.

It can be slipped into engagement so gently as to move the car a fraction of an inch, if desired, or the disk can be allowed to slip while running, thus permitting smooth control in traffic; or the car may be started from rest in high with the engine throttled down. Any amount of slip is not at all injurious, as in the case of a leather-faced clutch.

Special metal alloy composes the driving disk, and the driven wheel is faced with paper fiber. It is impossible to throw the transmission out of line as the disk is heavily ribbed and is carried immovably in a ball bearing and sleeve and is further supported at the forward end of the disk shaft by the crankshaft itself.

This support is obtained by slipping the forward end of the disk shaft into a pilot or hub bolted to the flywheel.

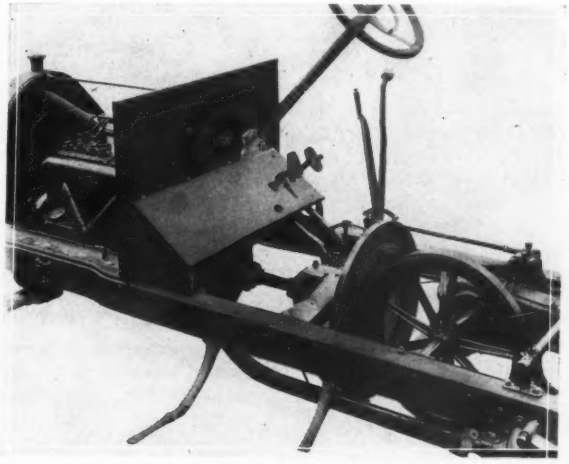
Wear of the metal disk is not appreciable and it is provided with a removable face which is easily replaced. The disk is independent of the motor, being free to move forward and backward and yet rotating with the motor through the medium of 2 flat steel plates bolted to a cross member carried on the forward end of the disk.

Operation of Transmission

BY means of the hand lever the friction wheel is placed in any desired position, and then the disk is brought into engagement by pressure on the left foot pedal. The right pedal operates the brake, so it will be seen that the car may be started and stopped entirely with the feet without taking the hands from the steering wheel. A small lever on the wheel itself regulates the speed of the motor by means of a throttle valve.

The thrust on the disk is scarcely any greater than the thrust on a clutch as used in other cars, and this thrust is carried on a bearing immediately in front of the disk, which bearing is of the 4-point type, and capable of carrying a far greater load than it would ever be called upon to bear. It is impossible for the motor to receive any thrust whatever, as transmission and motor are entirely independent as far as forward and backward motion is concerned.

Suspension of the chain case is at the front end on a universal joint which prevents any unequal movement of the frame from distorting or damaging it. The case also has adjustable plates which conform automatically to any position of the cross shaft. At the rear end the chain case surrounds the differential and real axle, and the differential and inside bearings receive their lubrication from the grease in the chain case, without the necessity for other attention.



CARTERCAR TRANSMISSION GEAR USED ON 45-HP. TOURING CAR

For several years a spur differential was used but the bevel type is employed at the present time. Bearings of the rear wheels as well as those of the differential are carried on the rear axle housing instead of the rear axle shaft. In a full floating axle the axle shafts carry no load.

Lubrication is by splash. The bottom part of the crankcase is divided into 4 compartments, and is provided with drainage troughs so arranged that each cylinder must of necessity get its own individual supply of oil regardless of road conditions, and also of any inequality in the dip of the connecting rods. Thus there is no possibility of any one cylinder receiving an excess of oil, with the resulting sootiness of piston, valves and spark plugs.

IN MIXING PLASTER of paris do not pour the water on the plaster, but turn the plaster gradually into the water, says Machinery, spreading it about in shaking it in and not stirring until all the plaster has been added. If mixed in this manner a smooth cream or thin dough without lumps will result. The proper quantity of gypsum is usually enough to peep out over the surface of the water over the greater part of the area; that is, about equal volumes of each ingredient. The addition of glue water to the mixture retards settling.

FROM AN ENGINEER FATHER TO HIS FIREMAN SON

Comments on Methods of Firing

MY DEAR SON:

Your very welcome letter of a few days ago was received and we read it over several times for the reason that you seem to be getting your feet under you, so to speak, in the fine art of firing a steam boiler, and, as you intimated that you would like to hear from home a little oftener, I will answer it now as I have a little time to spare before bedtime.

Well, Donald, my boy, I am more than glad that you have had another chance at the ladder that all real engineers must climb, and that you made good, at least eventually, if not at the beginning. Of course you do not surprise me when you tell me that you banked the fire trying to "keep 'er hot." That is a common error with beginners, and the queer part is, that some so-called firemen never seem to find it out.

They load up with perhaps a dozen or 15 scoops of coal a side and a process of cooling off takes place, accompanied by dense smoke which puts a nice carbon insulator over the entire heating surface of the boiler. In the meantime, the pressure goes down until the coal burns through and becomes incandescent. Incidentally, if the engines are carrying their economical load at the higher pressure, just as soon as it drops, then the steam consumption runs up 2 or 3 lb. per hour and the coal bill runs up 2 or 3 dollars a day also.

When this vast excess of coal becomes thoroughly ignited, the pressure goes up by leaps and bounds till the pop blows thus throwing away a few more nickels and dimes, till gradually the fire burns through in spots under the influence of an open damper and ashpit door letting in an increasing amount of excess air, till the boiler actually gets a chill, the steam falls 5 to 10 lb., more extra steam is consumed at the engine, and the entire process is repeated day after day, and day after day.

It is an actual fact that 99 out of every 100 so-called firemen never get any farther than right there, and the only reason that they stay on the job, is either because the boss doesn't know about it, or else is afraid that if he does fire one, that he will get another one a great deal worse, so of the 2 evils, he chooses the less.

You have been wheeling in coal now some little spell, and have been in a position to observe the ways of others, and to determine whether or not those ways were the best. You have even fired the boilers when Fred seemed to be indisposed (which, I understand, was quite often), and have taken lessons in the manipulation of a No. 5 scoop from a past master in the art, the Chief, and yet you had the idea that all there was to it was to open the firedoors and get the coal inside somehow, trusting to nature to do the rest.

So when you were suddenly thrown on your own resources, as soon as Fred brushed his brogans with a full grown gratebar and was lead away for repairs, you didn't have any more sense than to think that it was quitting time and time to bank the fire.

Then after it was all over but the regrets, I am glad that you were man enough not to blame it on some one else. You have perhaps met some men in your travels who never make a failure but that they straightway lay the blame on some one else, like a sort of straw boss who worked once where I was running an engine about 30 yr. ago.

When things were going smoothly and nicely this fellow would say "Now I'm a-gettin' it," but if everything seemed to be going backwards or something was broken, he would be the first to say, "Now look what you fellers did!"

So, Donny, I am glad that you did not resort to that method and try to lay the blame on the other fellow just because you did not know how to fire a boiler properly till you had it hammered into you by good old experience.

According to your letter, it did not take the Chief long to find out the difference in firemen, by looking at the top of the smokestack. Usually there is so much bluffing around the country that when there is any deviation from the usual run of events, somebody is going to sit up and observe.

Perhaps the women in the neighborhood were so used to having their washings spoiled by smoke from the stack of the Daneburg Mfg. Co., that when it began to behave in the orderly manner in which it should, they thought they were missing something and notified the Chief. Perhaps the smoke inspector may have had something to do with it also.

But it is surprising what a waste there is out the top of a smokestack, and practically all of it can be eliminated if the fireman but gets onto his job. It is very agreeable to note that you have established a record in firing, but do not by any means, make the common error of getting careless in firing, for if you do, you will loose the record, and also the confidence of the Chief, and confidence once lost, is doubly hard to regain.

Then there is another thing that has a great deal to do with ease and economy in firing a boiler, and that is the boiler feed pump. I have noticed that the habit is prevalent to carry the water level any place within the limits of the glass. This is all wrong, and it is about as reasonable as to water a horse once a week or so and expect that to last him till the next time. A camel can stand this once-a-week method, but it is almighty hard on a boiler.

The main thing is to adjust the feed pump so that it will supply the water just as fast as it is withdrawn from the boiler as steam. If you pump up and then stop the pump, you make it necessary to fire heavier during the period of pumping, and even then the pressure will drop some, perhaps to the detriment of the engines, as I said before.

Then when the pump is stopped the reverse takes place and a needless waste is incurred by continued blowing of the safety valves, till the fire gets low immediately preceeding the periodically heavy fire, when the pressure takes a drop, and away things go again.

There is an old maxim that, "A good fireman keeps 3 things level; the water, the fire, and his head," and let me tell you Donny boy, that there is more truth than fiction in it.

Well, Donny, I am glad that you didn't get cold feet over that first day's firing. That is where so many make a mistake, not only in firing but in everything. How often you run across fellows that tackle a job, and never having had much, if any, experience, they make a mistake and at once conclude that since

they "fell down" on it the first thing, that they cannot do it; and they tackle something else with the same result and about 3 of these semifailures makes these fellows real failures, whereas if they had stuck to the first difficulty a little longer, they would have won out and had confidence in themselves.

As it is, they have got the notion that no matter what they do, it is a failure, so the ailment gets to be chronic and they soon get an "oh-what's-the-use" expression in their faces and graduate into the "boomer" class.

Of course, firing is hard work. Anything is hard work, as far as that goes. Some men, it is said, find it hard work to spend their money while most of us find it hard work to get it. Be that as it may, there is a lot of satisfaction in learning to do a hard job and to do it well, better than the other fellows in similar lines are doing it. I remember that in my old copy book, that I learned to write in more years ago than I care to think about, I carefully copied these letters with raspberry ink in a blank book:

"Whatever is worth doing, is worth doing well." And this applies just as much to firing a boiler as it does to running a bank or a railroad.

So Donny, as you have learned a whole lot on the business end of that wheelbarrow and have had your chance to go higher, stiffen your MacDougal backbone, spit on your hands and go to it. Write soon and let us know how you are making out.

Mother says to wear woolen clothes in front of the boiler and I guess she knows. She made them for me for 50 yr. or more and knows what she is talking about. She has begun to knit you some socks already as they wear longer than boughten ones.

Affectionately, your father,
Sandy MacDougal.

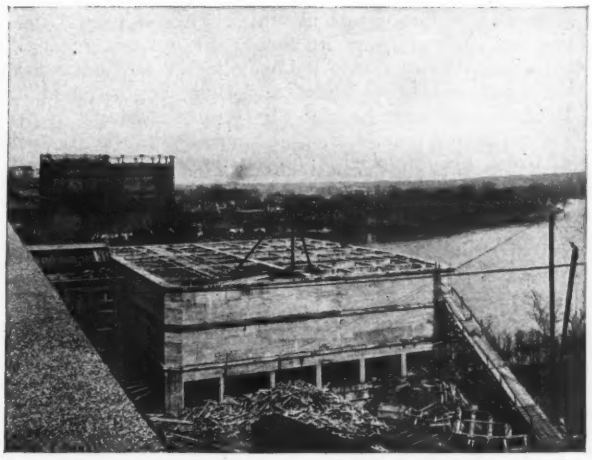
REINFORCED CONCRETE COAL POCKET

OF reinforced concrete and 10,000 ton capacity the coal pocket of the Pacific Mills Print Works, located on the south bank of the Merrimac River at South Lawrence, Mass., is nearing completion and is probably one of the largest coal pockets ever built of concrete. The coal pocket was constructed by the Aberthaw Construction Co., Boston, in accordance with the design of Lockwood, Greene & Co., of the same city. The work was carried on through the severely cold winter, necessary precautious having been taken for insuring satisfactory results.

It extends 119 ft. 7 in. to the east of the boiler house and is 153 ft. 3 in. in length, with a partially glazed monitor running its length on the western side and over the coal conveyor delivery. The roof is of 5-ply tar and gravel on 3-in. plank supported by 7.75-in. square pine columns with 8 by 12 in. and 10 by 14 in. pine columns.

The concrete piers rest on Simplex concrete piles. In the basement there are 6 longitudinal rows of 37-in. diameter reinforced concrete columns spaced generally 16 ft. 9 in. on centers. These columns support the heavy buttresses of the coal pocket floor, which slopes from each column down to the cast-iron thimbles through which the coal is discharged to the cars running on the industrial tracks in basement below. The coal pocket proper is about equally divided lengthwise by a concrete wall and it is divided across in thirds by 2 other concrete walls.

Coal is received from the railroad cars that run over a hopper located at the southwest end of the pocket. After passing through the hopper the coal goes through a Hunt coal cracker and is automatically emptied into buckets of a Hunt noiseless conveyor system and then taken immediately up to the roof. The conveyor driver is operated by motor. On reaching the roof the coal may be distributed in 2 ways. If it is desired for the 2 west side pockets, the coal from which is to be used daily, the buckets are tripped



REINFORCED CONCRETE COAL POCKET UNDER CONSTRUCTION

as they reach the proper set of double-sided chutes, 8 sets running lengthwise. For the other pockets the buckets run to the north end and there are tripped into a large hopper that fills a car running on an industrial track extending across the building with 4 branches that go over the other pockets that are used for storage purposes.

In the basement are 7 industrial tracks running lengthwise and converging into a main track to boiler house. The C. W. Hunt Co. furnished all the coal handling machinery according to specifications of Lockwood, Greene & Co.

CORRECTIONS

IN the article on Page 627 of the June 15th issue, by Mr. J. P. Fleming, some errors in proofreading occurred which should have correction. The title should be "Waters System of Heating and Ventilation," as the system was named after the inventor, T. J. Waters. On Page 628 the last clause in the first paragraph should read as follows: "Less heat will not maintain the required temperature, more than this is wasted." In the last paragraph on Page 628, the last sentence should read: "The most efficient results are obtained when the normal temperature of class rooms is secured with a minimum amount of tempered air passing through the mixing dampers."

IN THE MATTER of factory floors, it seems that the softer woods, like pine and fir, make a floor that is less slippery, but the hardwoods wear longest.—The Canadian Manufacturer.

REFRIGERATION AND BRINE

Comparison of Brines and Suggestion for Refrigerating Practice

By W. G. Walters

IN the equipment and installation of a refrigerating plant on the cold air system, provision must be made for a concentrator or evaporator tank. With the brine system, in which the brine is circulated through a series of coils, there is no need for an evaporator, as the quantity of brine remains constant. Due to the circulation of the air in the chilling of animal and other commodities in which there is humid heat, the quantity of brine in a cold air system gradually increases, the moisture being collected and carried by the air to the brine tanks, and there deposited in the latter by the process of cooling and washing. If provision be not made for this increase in the quantity of brine, the tanks would soon overflow and in addition its strength would be materially decreased.

Cloride of Calcium Brine

RESULTS show that the increase in quantity is much greater when the brine is made from chloride of calcium as compared with common salt. Calcium chloride is one of the best absorbers of moisture known to science.

This absorbing nature of chloride of calcium brine makes it of more value in a sanitary way, than brine made from other chemicals or salt. Another valuable feature is the economy of pumping. It can also be carried at a much lower temperature than salt brine, therefore, a proportionately smaller quantity need be pumped. One pound of brine, circulated at 10 deg. F. through coils in a room, which has to be maintained at 30 deg. F., is as efficient as 2 lb. circulated at 20 deg. F. Calcium brine is a much more fluid oily liquid than salt brine, and therefore, will flow through the pipes with less friction, effecting, thereby, a saving at the brine pump.

A chloride of calcium brine, testing about 80 deg. salinometer, has the same freezing point as a salt brine testing 100 deg. salinometer. It will be noted that salt brine is 20 deg. heavier than calcium brine and yet has the same freezing point, in other words, they will both carry the same unit of refrigeration; but if one solution is lighter in density than another, the lighter solution will absorb more heat per cubic foot and absorb it quicker, consequently a cubic foot of calcium brine passing through a pipe in a cold storage room will take more heat out of that room than would a cubic foot of salt brine, and do it quicker. This means that it is not necessary to pump as fast; the result being less power required for pumping and, therefore, a reduction in the fuel bill, and also an increase in refrigerating capacity. There will, however, be a slight increase in the amount of shrinkage in the cooling of animals, when chilling is done with cold air, but this will be offset by the improved sanitary conditions prevailing.

In the cold air system, the strength of the brine, while an important feature, is not as closely associated with the economical side of refrigeration as it is in the brine circulation system, for if the brine in the case of the cold air system is of a strong enough nature to keep the frost from forming on the expanding coils situated in the tanks, the unit-of-refrigerating effects will depend almost entirely on the amount of gas circulated by the ammonia compressor. In the case of the brine system, the units of refrigeration depend on the strength of the brine, and also on the amount of gas that is handled by the compressor.

Regulation of Temperature

IN cold storage rooms where the refrigerating work is regular and the temperature of the brine returning to the refrigerator is not liable to vary many degrees, the regulation of the temperature of the outgoing brine is an easy matter; but when the returning brine is subjected to large variations in temperature, the regulation of the outgoing brine temperature requires a great deal of attention. In the former case, the expansion valves are regulated so that the compressor maintains a suction pressure equivalent to a boiling point of the anhydrous ammonia, of about 15 deg. F. lower than the brine temperature required. For instance, in ice making, a brine temperature of 25 deg. F. would be the most economical, and 15 deg. lower than that, namely 10 deg. F. would be the temperature at which the ammonia should boil.

It will be understood that a suction gage pressure of about 24 lb. is equivalent to an ammonia boiling point of 10 deg. F. and, therefore, the expansion valves would require to be regulated so that the compressor ran with a suction gage pressure of say 23 lb. If a building has to be cooled and maintained at a temperature of zero, a brine temperature of about — 10 deg. F. will be necessary, and 15 deg. lower than that — 25 deg. F., will be the required boiling point of the ammonia, with a suction gage pressure on the compressor of about 1.5 lb. In both these cases, the expansion valves will require little or no attention after they have once been properly regulated.

Cooling Efficiency

IF, for instance, we have a quantity of hot lard to be cooled a certain number of degrees F. in a given time, it is necessary that the expansion valves shall be frequently attended to in order to obtain desired results. For example, 50,000 lb. of lard at a temperature of 100 deg. F. have to be cooled to 20 deg. F. or through 80 deg. F. in 24 hr. and the specific heat of the lard is 0.750. In this case, the number of thermal units to be extracted from the lard are $50{,}000 \times 80 \times 0.750 = 3{,}000{,}000$. Now, if the compressor is capable of circulating 43,200 cu. ft. of ammonia gas per 24 hr., and the expansion valves are regulated to give, at the commencement of the run, a brine temperature of 15 deg. F., then the refrigerating efficiency will be only 2,497,000 thermal units per 24 hr.; it will, therefore, take about 29½ hr. to cool the lard to 20 deg. F. If, however, the expansion valves are regulated so that for the first 6 hr. the brine temperature will be about 32 deg. F., during the next 12 hr. 25 deg. F, and for the remaining 6 hr., 15 deg. F., the refrigerating efficiency will be approximately:

First 6 hr.....	882,000 thermal units
Next 12 hr.....	1,542,000 thermal units
Last 6 hr.....	624,000 thermal units
Total	3,048,000 thermal units

This is 48,000 thermal units in excess of what is theoretically required, and 551,000 thermal units more than could be extracted by starting with and maintaining for 24 hr. the required final temperature of the brine, namely, 15 deg. F. This great difference in the results is due to the simple fact that the refrigerating efficiency of a system is proportional to the weight of anhydrous ammonia circulated. Therefore, if a large weight of ammonia is circulated at the commencement, when the temperature of the commodity to be cooled is high, and that weight be gradually reduced as it becomes cooled, it is evident that the lard or other hot substance will be cooled quicker than if the smaller weight, or that necessary for the final temperature is circulated throughout the whole of the operations.

Of course, it would not be advisable to regulate the expansion valves so as to cause 3 sudden drops in temperature as in the above example, where it was done for simplicity sake, and to illustrate how the desired results could be obtained. The valves should rather be gradually closed so that the minimum brine temperature required will be reached in about 6 hr. before the substance being cooled is wanted.

An important advantage of the cold air and brine circulating systems over the direct expansion system outside of the sanitary value, is the ability to store refrigerating energy in the brine tanks which may be utilized during the night, in case of shut-down or accident to some of the machinery, or in case of necessary repairs to the compressor.

In some establishments the brine is cooled in the day time, and enough refrigerating units are stored up in the tanks to allow the compressor to be shut down during the night; only the brine pumps and pans being run during the night. In these circumstances a larger system of expansion coils and brine tanks are installed. This arrangement tends to very economical operations, for in cases where the expansion coils and brine tanks are too small, the compressor will have to run at a higher rate of speed to produce the required amount of refrigeration in a given time. It is better, therefore, to have too much piping in a cold storage room than too little, for the extra cost at the start will more than pay for itself in the end. To run the compressor much faster in order to carry a lower back pressure to do the required amount of refrigeration, means a greater consumption of coal to operate the engine. If the amount of piping is sufficient, or even if there is excess, we can carry a higher back pressure, and as a consequence a greater amount of ammonia gas will be pumped back to the compressor and the work will be done fully as well and more economically.

In summing up on mechanical refrigeration allow me to say that in the control and operation of the modern refrigeration plant, be it small or large, nothing can exceed, in favorable results, the personal care of an expert engineer, because automatic mechanisms are less important than the watchful attention of an able and experienced man. While this idea of the value of personality is perhaps true in all the arts and crafts, and always has been, it is particularly true in the manifold details necessary to successful mechnical refrigeration, owing to the varying and unique circumstances which distinguish the art of refrigeration and preservation.—The Power House.

ICE MAKING AND REFRIGERATING MACHINES*

Installing Brine and Ice Tanks

By William H. Beisley

If set on the ground, place these on a good brick or concrete foundation of ample proportion to prevent any settling, which might cause leaks in tanks or coils therein; if it should be an ice tank, this would give trouble by springing the frame and allowing the ice cans to be uneven in the tank. On top of this foundation should be built the floor, and insulation for the bottom of the tank and no expense should be spared in providing a good insulation, every means at hand should be used to protect the foundation, and insulation from water and dampness. Should there be danger of water finding its way under the tank, it should be protected by laying a drain around the outside of the foundation to carry away any water that otherwise might find its way under the tank.

The greatest care should be used in selecting the material for insulating bottom and sides, of which there are several on the market suitable for the purpose, and too much caution cannot be exercised in the insulation. There are many cases where good material has been condemned when the fault really lay with the method employed in placing it.

The bottom of tank should be protected with from 3 to 5 in. of good material, layed down in hot asphalt, and all transverse joints being broken. Should there be more than one layer of material used, care must be taken to break all joints with respect to the joints in the first layer. After insulation has been placed in position this should be covered with hot asphalt or pitch, and the tank lowered onto it at once. It is the experience of engineers that a heavy insulation on the bottom of the tank is money well invested, as it materially increases the output.

Sides should be protected with retaining walls of lumber regardless of what material may be used, leaving the required space between walls and tanks for insulating material; usually this should be from 10 to 12 in. Should the insulation used be in board or block form, the side of the tank should be studded with 2 by 3 or 3 by 3 timbers, securely attached to tank at such distance apart that the sheets or blocks will fit between them; and to these the blocks should be firmly attached. Against this a second course should be placed well bedded in hot tar or asphalt and well nailed to the first course and to the studding, and then finished off on the outside with a ½-in. coat of cement plaster.

All tanks that are to be insulated should be given a thorough test for leaks, which can best be done by filling them with water and then giving them careful inspection. Should any leaks appear, the sheets should be trimmed and calked tight.

To make a quickly settling rust joint cement use 1 part sal-ammoniac in powder (by weight), 2 flour of sulphur, 80 iron borings, made to a paste with water.

To make a slowly settling rust joint cement use 2 parts sal-ammoniac, 1 flour of sulphur, 200 iron borings. This cement is best if the joint is not required for immediate use.

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*Continued from May 15 issue.

LETTERS DIRECT FROM THE PLANT

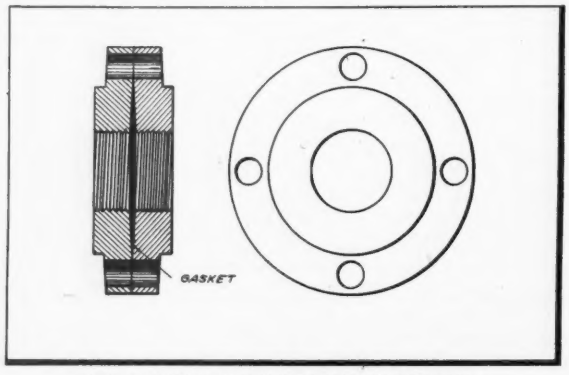
Cash Paid For Ideas Accepted. Sketches Desirable.
We Make The Drawings

PROPER GASKET FOR FLANGE JOINTS

IN connecting a flange piping, the first thing is to screw the 2 halves of the joint on their respective pieces of pipe, then bring the flanges in place so that the bolt holes are in line with each other. You can open the space for the gasket to enter by driving a chisel between the flanges; be sure the nuts on the bolts don't prevent it from opening. If the pipe line is horizontal, the bolts can be placed in bottom half, or if it is a vertical pipe line half of the bolts can be placed in position so as to let the gasket slip in easily, being very careful when entering the gasket that it touches the bolts that are already in position so as not to interfere in placing the rest of the bolts.

Flange joints are packed with fibrous gaskets cut large enough so as to fit in between the bolt holes of flange and the outside diameter of pipe, as shown in the drawing. The most accurate way to cut these gaskets is by the use of dividers to get the proper dimensions.

The narrow gasket is less liable to blow out under pressure than the wide one and must be adjusted carefully, for if it is put in place and the nut on one bolt turned on as far as possible, the flange will be thrown out of line, causing it to leak.



PIPE FLANGE AND JOINT SHOWING PACKING

To prevent this it is necessary to screw up one nut tight enough to clamp the gasket lightly, then apply force to another opposite side. Treat one between these in like manner, then one opposite and continue this process until all are as tight as it is safe to make them, and if it is a steam line should be followed up after steam is turned on.

When the nuts are tight enough all around, the outside edges in both halves of the union will touch each other, as shown in drawing, preventing the gasket from being blown when under pressure. 1/16-in. rubber packing should be used in normal conditions. When the alignment is faulty or face of flange is corrugated or rough 1/8-in. packing must be used to obtain the best results.

Lewis A. Danner.

BACK NUMBERS

THE above title might be applied to men, but in this instance is meant your valuable journal.

Owing to the death of my wife, all my "back numbers," nearly, were packed away with my library, and all of those now at hand—old friends—are upon my desk, here in the engine room. The one of Aug. 1, 1908, has been one of the most interesting, being full of juicy morsels.

In it I find a most comprehensive description of the "double flow" turbines, a type of engine that has always held my deepest admiration; being a little mysterious, and to a great extent unknown by me. Also the article on "Ammonia compressors" is most interesting, and instructive. Going farther along, we reach the "Letters from engineers," among the various "letters" at the time this issue came out, I took advantage of Chas M. Green's description of a "jack," and made one for my own use, which proved to be a great help. I find, also, several answers to a question previously asked by one Gus A. Janicke and the amazing part of it is, that the question, though answered, is still unanswered. Sounds strange doesn't it? Yet I wonder how many of the fellows will hunt up this particular "issue" and learn the answer to the enigma.

But of all the fool things that it has even been my misfortune to read, is the "Handy scale remover's" descriptions by W. S. Hudgins. Like every one else, I have my troubles and my cares, and when ever I feel tired or worn out, and life seems like a never ending night, then I go read Hudgins article, and have a laugh. Even now, as I look on the cut labeled Fig. 1, "it is to laugh." Look it up old timers, and partake of my mirth.

After reading the article on page 71, regarding the "Titan" valve, I at once ordered one for a special purpose, and it has made good.

In December, 1908, issue, I find the description of a system of installation for d.c. motors and generators. Having been, at one time, an erecting man, I had, in my opinion, the installing art down pretty fine, but I wish to state, that any of the boys, be they old, or young, at engineering, may find under the above title, something well worth filing away for reference. To those who are just starting out, especially, should this apply, for it may be the means of saving them lots of worry, and perhaps their reputation, should they ever have any of this class of erecting to do.

"The ejecting pump" by Mason, same issue, I learned to make before I ever started my apprenticeship, over 23 yr. ago. Nevertheless, it's all there with the delivery. O. W. R.'s dashpot looks good, and I wonder why some of our standard Corliss machines are not so equipped. It is apparently a far better type than the "pot" in general use, owing, as he says, to the fact that they are nearly all "catch basins" for lots of oil, dust, and drippings.

And over in the editorial columns are 2 pages of

something good. "Backward, turn backward," fellows, and take the pleasure of reading it once more.

But on page 44, of this Dec. 1908 issue, I find something by P. E. Merriam, which I can't force myself to understand. I refer to Merriam's setting of the "single eccentric gear" valve. I've tried his system on a number of engines, and since it doesn't "work out" in theory, I find, also, that it doesn't in practice.

I agree with him, until we reach the point where he says to "give the engine valves, their proper 'lap' by adjusting the 'radial rods.'" Now suppose we do this; then how are we to get the lead? He says by shifting the eccentric. Very good—only in shifting the eccentric, we can't do it—not so well. For instance, we get the proper lap on head end valve, we shift the eccentric until we have the "lead," then we adjust the dash-pot rod. All this on the head end. So far, so good.

Now we lock our eccentric, turn the engine over to crank end center, and—he says—"see if the steam valve has the same lead, and if not adjust the lead by shortening, or lengthening, the "radial rod." Now if we change the radial rod, after having set it for lap, why is it not natural to suppose that we destroy the lap given? And if we shift the eccentric back, to favor the crank end lead do we not then destroy the lead already obtained on the head end?

Jumping ahead several months, to March, 1909, the first thing that I see, as I open up the book, is where the Editor is a little scared about the timber going to give out. I wonder why he needs worry when all his work is about metals? Perhaps he is afraid that his chair will wear out, and there won't be sufficient wood, to build another one, and he asks us about "diluted steam, for engines," and says, "don't all speak at once." Really we must have taken him too seriously, as to date I've not heard a single murmur. Better go back, fellows, and see what he says, and make him an answer. He has me guessing, and I can't swim.

In the same issue, J. M. tells us a lot about "chlorides, sunlight, and boiler explosions." By the way, we heard quite a lot about the dangers of "chlorides" a few years ago. What's the matter: has it gone out of style?

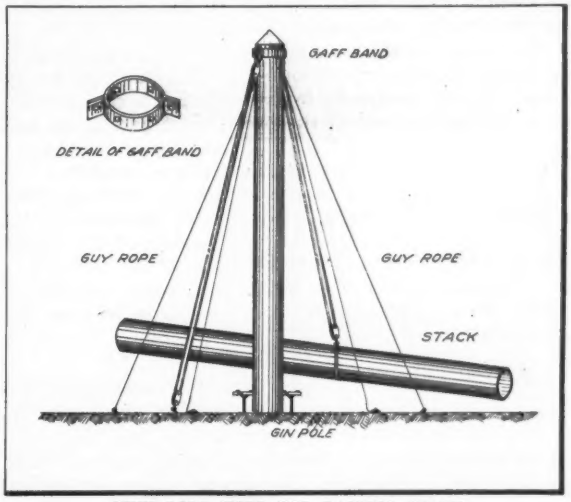
S. H. W. asks a few questions, and ye Editor gets his goat in one of his answers, as regards a water glass, which shows when the boiler is only half full of water.

I have quite a number yet, of old issues, here at hand, but there is so much in each of them, all of which merits our praise, that I am going to stop, else I'd go on forever, if I kept trying to tell it all. It seems to me, however, that one is indeed fortunate to have had the saving bump and kept his numbers of Practical Engineer. It is the best reference library one can get, not only in theory, but in its practical letters; and reading over, and studying these old back numbers may keep lots of us fellows from becoming "old back numbers," ourselves.

John Pierce.

GINN POLE FOR HANDLING STACK

IN erecting a new stack and also in removing an old one a ginn pole is a great help. I employ for this purpose a long, stout pole pivoted at its butt end on a bar, as shown in sketch, which is lashed to 2 stakes driven firmly into the ground close beside the desired position of the pole. Then the pole is hoisted into a vertical position by hauling on the guy lines and men "walking" it up. When vertical its guys are made fast to "dead men." These "dead men" are made from stout planks in the form of a cross 2 or 3 ft. long and the arms connected together by a long eye-bolt fastened with nuts above and below the planks; the crossed planks or "dead men" must be buried about 3 ft. with the eye of the connecting bolt above the surface; a gaff band with double eye, as per sketch, will be found convenient for holding a block and the rear guy so that the pole can be swung a little from the vertical if necessary. This gaff band



GINN POLE USED FOR RAISING STACK

must, of course, be sufficiently high on the pole so that the stack can swing clear to its foundation. By making the sling fast a little above the center of gravity of the stack and attaching the guys on the stack in their proper position, with a guiding line at the bottom, the stack can be placed on the foundation by hauling in and paying out as necessary on either. Three-sheave blocks would be about right. Wm. Chaddick.

USING THE INDICATOR

IN regard to the recent article on reckoning with the indicator, I believe the indicator is accurate and correct when properly handled, but when attached to a Corliss engine with a cylinder 66 in. long at the end of a pipe and with elbows and bends, the indicator will be a bad actor. The right way to use an indicator is to screw it in on one side of the cylinder as close as you can come. Be sure that it is in good working order and it should give close to a theoretical diagram. In setting the valves of an engine, each engine must be set according to its own peculiarity. The 3500-hp. engine having the valves set so that it will stick when it is only a 2000 hp. load may call for severe criticism. L. S. Blain.

OVERCOMING VALVE STEM AND ROD LEAKS

FOR a long time we have been troubled with leakage of ammonia around the valve stem of the gas valve between cooler and absorber. We tried repacking it several times, but with no result. Then we tried packing it with packing soaked in brine and this time it lasted a little while longer, but the leak soon appeared again. Then we ordered a new valve stem and gland and put them in and repacked again with packing soaked in brine, but the stem leaked again after a week or so. We were at a loss. What puzzled us most was that the gas valve on our other machine never gave any trouble. Our chief one day worked

out the puzzle. He noticed that the valve on the first mentioned machine was of the movable stem type and that the valve that gave no trouble was a stationary stem valve. The problem was solved. We ordered a stationary stem valve to replace the troublesome one, installed it and we have been happy over it since. The valve has given no more trouble. I have noticed since that all other valves of the movable stem type on ammonia work leak around the stems more than do the others. Have other readers of the magazine had any experience along that line?

Another trouble we had was with the packing of the ammonia rods of our pumps. The packing would break up and ammonia leak badly from the stuffing box. We would repack the boxes time and again and still the packing would crumble and leak. The boxes would get hot and the rods would wear quickly. We could not seem to hit upon the remedy until we tried using smaller packing and the trouble was over. We were using too large packing. It would fit the boxes tightly when first put in and that would not allow for expansion after the pump had been running a while. Using packing about 1/16 in. smaller than the box cured the trouble. Frederick M. Perras.

SHOWER BATH FOR THE BOILER ROOM

SHOWER baths are not always provided for in the original layout of a power plant, but this convenience may often be installed at small expense even where space is limited. In the arrangement shown herewith the shower was placed in the center of the

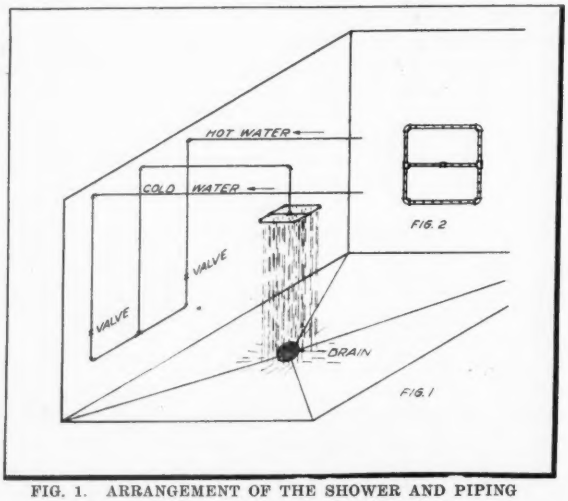


FIG. 1. ARRANGEMENT OF THE SHOWER AND PIPING
FIG. 2. DETAIL OF THE SHOWER HEAD

boiler room, over a drain which served to carry away water when washing floors. Most of the piping was taken from the scrap pile, the shower attachment representing the principal expense of the outfit, the total cost of which did not exceed $3.

A substitute for the more elaborate attachment could be made by connecting short lengths of pipe, having small holes drilled in the lower sides. A screen was made by tacking cloth on a wooden frame, which could be set aside when not in use.

KEEPING VALVES AND PISTONS TIGHT

MUCH can be done in keeping the wearing surfaces of valves and pistons in good condition in the case of Corliss valves by drawfiling the heads and the body of the valve back from controlling edge; this roughened surface will wear faster and give that part of the valve and seat necessary to tightness a chance to make a good contact.

If this is not done the heads of the valve having so much more surface and not being subjected to the cutting and corrosive action of the steam and water will ride the hardest and prevent the working part of the valve from bearing hard enough to make a tight joint. We always, when we have the packing and bull ring out, file all ridges off so that when put back they will rub hardest on the ridges in the cylinder, thereby wearing them down. We also always replace them in the cylinder in the same position as regards the bottom of the cylinder. Theoretically a truly cylindrical bull ring in a true cylinder will only bear at a point, but the bearing will increase with wear until it may amount to almost half the area of the ring. This line of reasoning leads us to believe that a cylinder will wear out of true much faster where the rings are changed at each inspection than if replaced in the same position.

I believe it is the usual practice to remove the sharp edges of the rings on the theory that the oil will more surely get in between the piston and cylinder, anyway it has always been our custom to do so.

Could some brother tell me which side of the groove the packing ring hugs? Does the friction cause it to lay against the back side or does the steam pressure force it against the front side? J. O. Benefiel.

CONNECTING ROD DESIGN AND ADJUSTMENTS

SOME ENGINEERS do not have a clear understanding of the design of various types of connecting rod ends, and as this knowledge is essential, in order to make adjustments and avoid getting into trouble, a short article along that line may be helpful.

If a bearing is running cool, and without any noticeable noise, let it alone; that desire to get the last thousandth of an inch out of a bearing has led to more than one shut down.

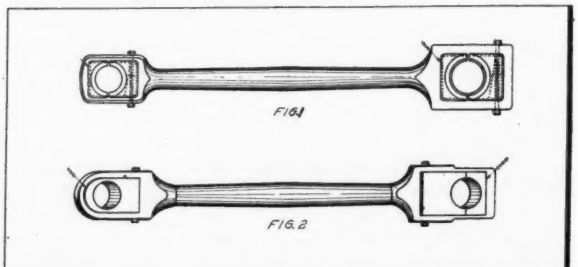


FIG. 1. SOLID END CONNECTING ROD SHOWING LOCATION OF SHIMS
FIG. 2. DESIGN OF ROD WHICH BECOMES LONGER WITH WEAR

While it is necessary to keep a close watch on all bearings at all times, a bearing which has just been taken up should be made the object of especial attention for the first few hours run at least. Another matter of importance is the piston clearance. Every time we take up the wear in the crosshead or crank pin boxes we change the center to center distance between the pins, thus affecting the piston clearance. True, it is a very small amount at each adjustment, but in time it becomes sufficient to require attention, and we have to determine how much it really is and add shims, which is the remedy.

Different methods of obtaining the clearance can

be used. If we have an engine in which the piston rod is forced into the crosshead under pressure, taper fit, we can disconnect the connecting rod from the crosshead, and push the piston until it strikes the head end, and make a mark on the guide at the end of the crosshead shoe, and after pulling the piston back until it strikes the crank end, make a mark at the other end of the guides. The distance between these 2 marks will represent the total length of the cylinder. Then we connect up the connecting rod and, placing the engine first on one dead center and then on the other, make a mark on the guides at the end of each stroke. The distance between these marks and the first ones made will represent the clearance.

If we have an engine in which the piston rod is threaded and screwed into the crosshead, secured with a lock nut, we place the engine first on the crank end dead center, and make a mark on the rod, against the face of the nut, denoting its original position, then slack off the nut, and move it back on the rod, say half an inch, and after measuring between the nut and the crosshead, screw the rod in until the piston strikes the head. Now measure the distance again; the difference will be the clearance. Then set the engine on the opposite dead center, and screw the rod out until the piston strikes the head end, the distance between the nut, after being placed in its original position, and the crosshead, will be the clearance for that end. Great care must be used that the nut does not get moved between measurements, otherwise the results would not be accurate.

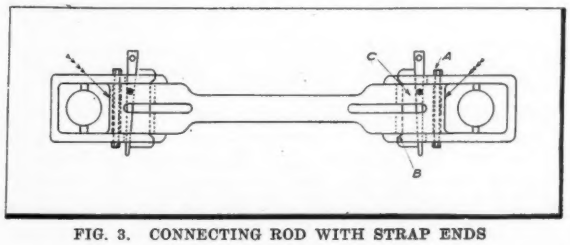


FIG. 3. CONNECTING ROD WITH STRAP ENDS

If we have a Corliss engine we can place it on dead centers and, taking out the exhaust valves, measure the clearance through the exhaust port. Suppose we had a large engine, belted to a friction load which made the moving of the engine by hand out of the question, we can take out the indicator pipes and, holding a small stick of soft solder in the openings, have the engine turned a few strokes by steam; then by calipering the lead thus obtained the clearance is readily found. Having obtained the inequality of clearance, the next question is, where shall we put the shims? The location of the shims varies with the design of the rod end.

Connecting rod ends are of the following general types: Solid end, with wedge or key adjustment; open end, with strap and key adjustment; open end, with strap, gib and key adjustment; and marine end, which is simply 2 babbitt lined parts bolted together with liners between, not unlike an eccentric strap in appearance, no allowance being made for adjustment except by the removal of the liners or shims until, when the limit of the shims is reached, it becomes necessary to rebabbitt the parts, and replace the shims. This design is used on the crank end of center crank engines, the crosshead end being equipped with some form of wedge or key adjustment.

In the solid end rod with wedge adjustment the wedge may be designed to draw up from the bottom, down from the top, or in from the side, but this should not prove confusing, as it really has no bearing on the location of the shims. The wedges or keys may be one outside of the pins and the other between the pins as in Fig 1. Taking up the wear on the crosshead end of this rod tends to increase the center to center distance between the pins, thus decreasing the clearance on the head end, while taking up on the crank end has the opposite effect, the result being to keep the rod of constant length, but for the reason that most of the wear is on the crank end, allowance must be made for this difference. The location of shims in each of the figures is denoted by the small arrows.

In the rod shown in Fig. 2 both adjustments are between the pins. Taking up the wear with this design has a tendency to lengthen the rod, decreasing the clearance on the head end; this applies to both ends of the rod, and this same is true of the open end rod with strap and key adjustment.

The open end rod with strap gib-and-key adjustment presents some very interesting features. This rod as used by the builders of the McIntosh-Seymour engines, is shown in Fig. 3.

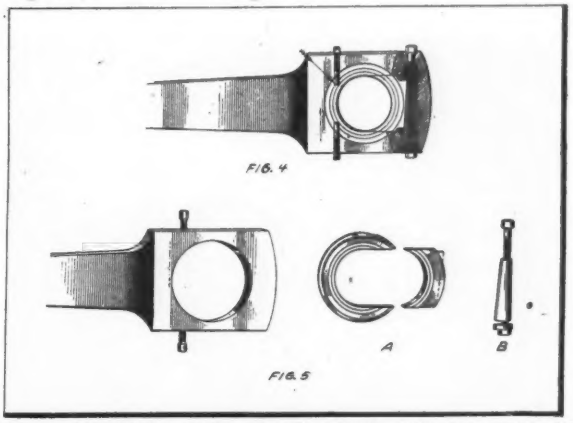


FIG. 4. SECTIONAL VIEW OF CONNECTING ROD END USED ON IDEAL ENGINES

FIG. 5 DETAILS OF CONNECTING ROD END SHOWN IN FIG. 4

The strap is prevented from spreading by a bolt A which passes through the rod and strap, and also by the V-shaped impressions in the gib engaging corresponding projections on the strap, as at B. The bolt is a tight fit where it passes through the strap, but the hole through the rod is enlarged, as shown by the dotted lines, thus allowing the bolt to move when making adjustments.

The gib and key are only about half as thick as the strap which is slotted out to receive both. The portion of the gib C between the ends of the strap, does not bear on the rod, and the straight side of the key has no bearing on the strap (see dotted lines), so that when driving down on the key the bearing is from the straight side of the key against the rod, transmitted to the butt box on one side, to the V-shaped joint made by the gib and strap at the other side, the combined result being to push the end of the rod toward the pin, carrying the butt box with it, and to pull the strap on over the rod, thus moving the crown box toward the pin. This combined action will tend to shorten the center to center distance between the pins, decreasing the clearance on the crank end. This applies to both ends of the rod. This we see, is the exact opposite of the effect produced in Fig. 2, where, as in Fig. 3, the adjustments were both between the pins. Note the difference in the location of the shims.

Figure 4 represents a type of rod end which is interesting, and is used by A. L. Ide & Sons, on Ideal

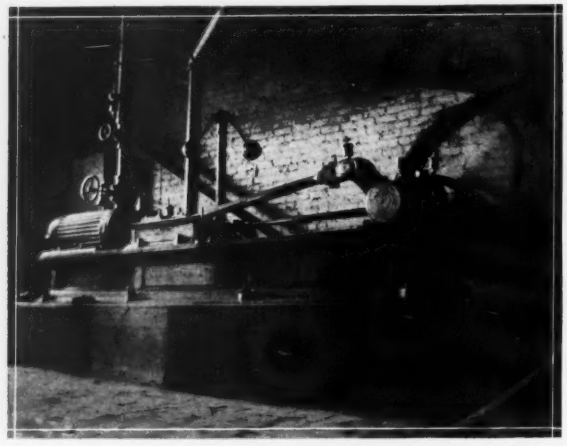
side crank engines of over 80 hp. In Fig. 4 the end of the rod is shown in sections, thus giving a good view of the adjustable parts. Figure 5 shows the rod with the adjustments removed, the shaded part denoting how the rod is slotted out to take the movable part of the boxes. A and B are the boxes and wedge. The material used in these boxes is finished cast steel, babbitt lined, on the crank end, and on the cross head end phosphor bronze, babbitt lined.

Bronze boxes with babbitt lining are commonly used as materials in rod end construction, steel and brass boxes being the exceptions. While there are details of construction used by various builders, of which no mention has been made here, this article covers the principal features of representative types.

J. A. Levy.

IN SERVICE FIFTYTWO YEARS

I AM sending you a picture of an engine that has been running for 52 yr. and is doing good service yet; the cylinder is 10¾ by 20 in. and runs 100 r.p.m. It



FIFTY-TWO YEAR OLD ENGINE

is located in the Williams chair factory, Toledo, O.

B. A. Held.

POWER PLANT DIVERSIONS

WE were a bit short on boiler capacity and were bothered holding our pressure during the peak load. One of the firemen being taken ill an Irish coal passer was put on 2 of the fires just before the "pull" came on. I told him "Now, Mike, do your share and hold her if you can." The peak load had been on about half an hour when the steam dropped 5 lb. I stepped into the boiler room and meeting Mike said, "Mike, we have lost a bit on them." "Sure," he replied, "but I have lost nothing on the shovel deal I have here."

The following happened just a few months ago:

I was called into a plant where I formerly worked to see what was the trouble with the "pop." I asked the fireman, "How often does she blow?" He looked at me a minute and then said: "Blow—h-l! The boss does all the 'blowing' around here." (And truth it is, too.)

In addition to the jokes above my experience with the manager under whom I once held the position as engineer may be of interest.

The engine was working under very unfavorable conditions of slow speed and low initial pressure. I attempted to persuade the manager that an increase of speed and pressure would give him the power at a less fuel expense. I desired to increase the speed from 105 to 125 r.p.m., and the pressure from 90 to 115 lb. per square inch, the boiler being allowed 125. The matter was discussed during which time such matters as shorter cutoff," "longer expansions" and so forth, were mentioned. It ended when the manager came forth with this: "You can't convince me that you can save any fuel when it takes more fire to make the pressure higher; and furthermore, if you run the engine faster she'll wear out sooner, and take more oil besides."

The writer gave up and took a position elsewhere.

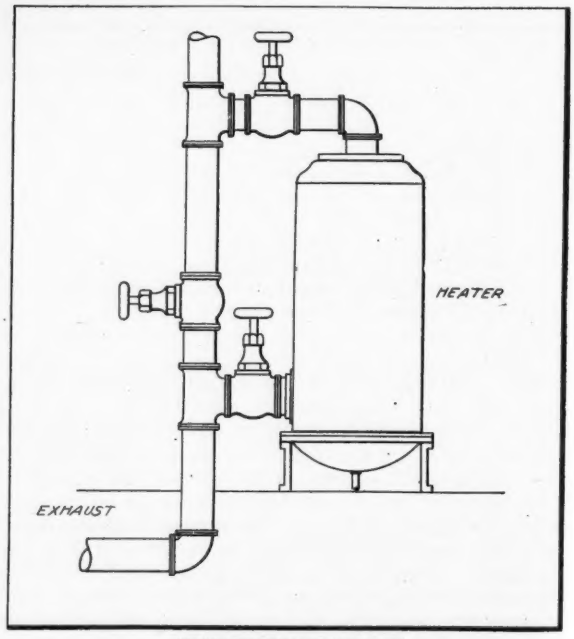
Once, when asking for an injector or other means of boiler feed to supplement the one lone duplex we then had, the writer was informed that "the pump was a double pump anyhow so it was good as two and no other was needed." Not long afterward this wonderful double pump had the misfortune to break a valve rod and the writer rigged a lever of wood by which the water level in the boilers was raised so as to shut down until repairs were made. The following week an injector came.

These illustrate what some of the boys have to contend with. Is it any wonder that we get discouraged and "blue"? It is little satisfaction to try to help a man who won't help himself; yet such is the lot of many of us.

I. M. Coming.

FEED-WATER HEATER CONNECTIONS

HEREWITH is a sketch of a connection to a heater which I think is an improvement over that shown in the May 1st issue by C. R. McGahey, as it will per



CONNECTIONS TO HEATER

mit cutting out the heater for cleaning or repairs without interfering with the engine, which the other will not.

H. M. Stempert.

Successful Kinks From The Plant

For Saving Time, Work and Trouble

An Emergency Economizer Repair

A FLANGE on the discharge end of one of the 4-inch circulating tees in our economizer cracked and broke off as shown by Fig. 1. As the boilers were overloaded, even with the economizer in service, we could not spare the economizer until a new tee arrived, which would take at least 3 days.

I mixed some smooth-on cement to a paste and applied it to the flange and the piece which had broken off. I then clamped it in place and let it stand for 1

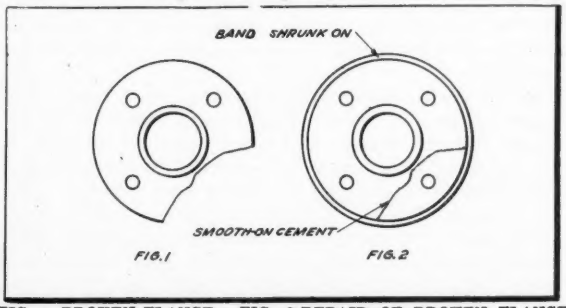
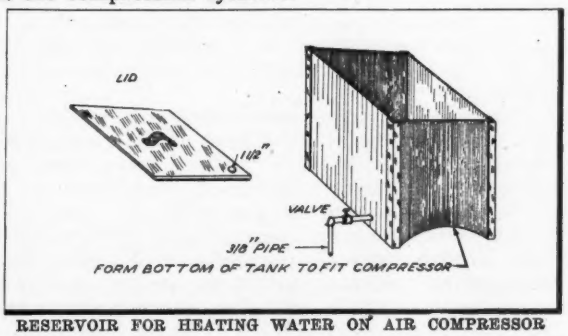


FIG. 1. BROKEN FLANGE FIG. 2. REPAIR OF BROKEN FLANGE

hr. In the meantime I got some ⅜ by 1/16-in. wrought iron stock and made a band 1/32 in. less inside diameter than the outside diameter of the flange. I then heated the band to a cherry red and drove it on the flange as shown in Fig. 2. In making the joint I pulled up the 3 bolts in the solid part of the flange first and then followed up with the bolt in the repaired part. This repair was made 5 months ago and the economizer is carrying 120 lb. pressure and up to date has shown no leak. John J. Mahoney.

Warming Water on Air Compressor

I AM working with a motor driven air compressor and have no steam or heat about the place during the summer months. It was quite necessary as well as convenient to have hot water, so I had a tank of about 8 gal. capacity made with a curved bottom to fit the compression cylinder.



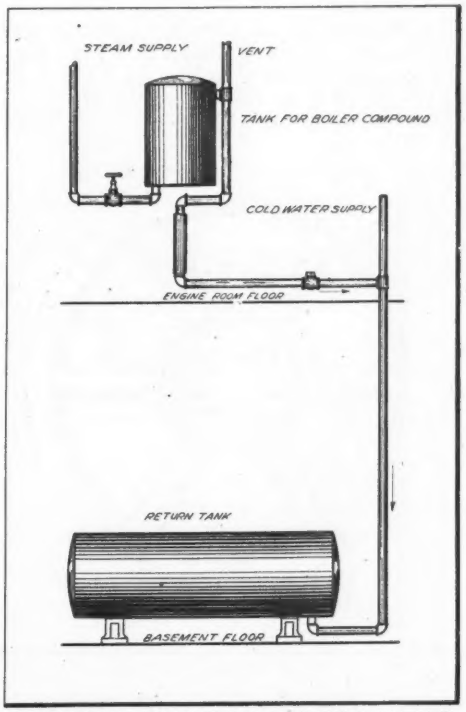
RESERVOIR FOR HEATING WATER ON AIR COMPRESSOR

It will heat the water quite warm, and to keep it warm when the compressor it not working, I cut a hole in the lid 1½ in. in diameter and put a 16-c.p. lamp in the water. Chas. Sawyer.

Boiler Compound Feeder

I HAVE a habit of visiting engine rooms to see what I can learn, and the other day I ran across this novel boiler compound feeder. It is used for the boiler compound, which is powdered, but it could be used also for that which is in lumps, in fact by putting a drain pipe from bottom to feed line to empty it before refilling, it could be used for liquids.

The boiler compound is put into the tank provided for that purpose, then water added up to the side outlet, the steam valve is then opened slightly to boil



CONNECTIONS FOR BOILER COMPOUND FEEDER

and dissolve the compound. The water which results from a mixture of steam will flow down the overflow pipe to the return tank. The amount of opening of the steam valve depends upon how fast you want to put the compound into the returns, also it should not be opened too much or it will boil over and be wasted. The cold water supply takes care of the vapor in the line, also helps to make up for losses in the heating system. It is a simple device which has been in use some time and has given very satisfactory results.

John Mitchell.

WE ALL HAVE THE same twenty-four hours to work with; and the man who piles up the biggest balance of achievement, or money and success, is the man who knows best how to work with this period, and how to get the most out of it.—Cord Age.

Questions Answered and For Answer

Expert Help When In Trouble. If You Want Quick Answer Enclose a Stamp

Governor Adjustment

I WAS employed as helper to an engineer who was installing an Ideal engine 10 by 10 in., running at 350 r.p.m.

In changing the governor pin at A, would it be necessary to readjust the valves?

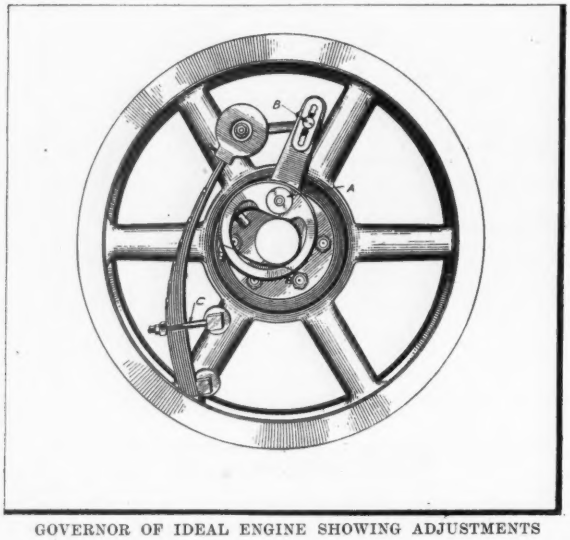
How would you make the governor sensitive or more sluggish?

Which way would you move the pin at B for the different changes?

Before starting up the engine the engineer screwed the nuts down to the last thread at C; the engine ran at 430 r.p.m. on the start.

What caused it to run so much faster?

A. G. P.



GOVERNOR OF IDEAL ENGINE SHOWING ADJUSTMENTS

A. The governor shown consists of a single spring, carrying at its free end a weight. The weight is connected to a heavy arm carrying the eccentric pin, by means of a link, pivoted at point B on the arm. The arm turns about the main governor pin A. Tightening the spring bolt C increases the tension of the spring, requiring the engine to run faster in order to force the weight out to any given position. This explains why the engine ran at 430 r.p.m. when started with the bolt C tightened to its limit.

Connecting the link closer to pin A, by moving pin B to one of the inner holes, causes the eccentric arm to move further for a given travel of the spring and weight, and thus increases the sensitiveness of the governor. Conversely, connecting pin B further out on the eccentric arm, decreases the movement of the eccentric arm for a given travel of the spring and weight, and makes the governor less sensitive; i. e., permits a greater increase of speed from full load to no load.

Strictly speaking, the terms "sensitive" and "sluggish" are not opposites, but refer to different qualities of the governor. A "sensitive" governor is one that holds the engine very close to the specified speed, even though the load be changed considerably; thus, an extremely sensitive governor may permit an engine to increase its speed only one revolution from full load to no load. A "sluggish" governor, on the other hand, might be equally sensitive, but on a sudden release in load the engine might gain in speed ten revolutions per minute, and then slow down again, continuing finally to run only one revolution faster than before. Similarly, a sudden increase of load would cause an engine with a sluggish governor to drop in speed several revolutions per minute, and then increase close to the former point. Governors should, therefore, be as far from sluggish as possible, i. e., quick acting, so that there may be no excessive changes in speed due to the governor being too slow in catching up with the change in load; and they should be no more sensitive than required for the work. An oversensitive governor always acts badly, for it changes position so quickly following a change in load that it over-runs the proper position and the engine "hunts."

It would seem unnecessary to re-set the valve of an engine after taking the governor apart and putting it back in the same position; yet, since single-valve high-speed engines have extremely small port openings, it seems to be rarely the case that the governor can be put together again so close to the original setting that the valve will not require to be readjusted.

Sterling H. Bunnell.

Trouble in Ice Plant

I AM running a 10 ton ice plant of the Cleveland Ice Machine Co.'s make and the ice is far from satisfactory. We are troubled with red ice and at the bottom of each cake there is a white spot 6 by 12 in., tapering up for about 8 in. The center of the cake has a peculiar odor and a bitter taste. We use exhaust steam with an oil separator; an atmospherical condenser; a circular reboiler 3 by 2½ ft., and a heating coil with 1-in. pipe inlet, ¾-in. outlet and ½-in. pipe running to the condenser.

The pure water is skimmed in the reboiler and again in the skimming tank from which water goes to the flat cooler, to charcoal filters, to forecooler, then through a filter of three layers of cotton cloth.

What kind of cloth is best for the last filter? The cooling water for condensers is taken from a flowing well and for drinking purposes is all right. After running over ammonia and steam condensers it is fed to the boiler at 175 deg. F. The scale in boiler is hard, but there is not much of it. The water in the ice cans is clear and has a pleasant taste.

There are no leaks and all piping is kept blown out with steam. What kind of acid or soda could be run through a pure water system to thoroughly cleanse it

from oil and foreign matter? I have tried leaving the reboiler shut off, but it makes the ice cloudy. What I want to eliminate is that odor and bitter taste; it is the worst at the bottom of the cake. The brine in the freezing tank is kept at 16 deg. F. I. B. F.

A. From our experience with different waters, we are inclined to think that your trouble is mostly due to dirty or crowded boilers. While we are not acquainted with the water in your district, we know that waters that contain alkali and magnesia, and when the steam boilers become foul and dirty the decomposition of the scale on hot surfaces produces a gas that is readily absorbed and held in solution in the distilled water.

We know of no filter that will remove matter from water that is held in solution. We should advise you to blow your boilers frequently, say from one-half to one gage every 6 hours or as often as your judgment deems necessary, and wash the boiler as often as every 2 weeks. Should your boilers have a tendency to prime or foam, you should provide a separator for your steam line if you have not one at the present time, and the drain from this should be led through some good trap to the sewer. The steam that you use for the reboiler should be taken from the main after it has passed through the separator, as any water that might otherwise be thrown over from your boilers, which would be very dirty, would be discharged through the coil in the reboiler into your condensor and mingle with your distilled water.

You should thoroughly steam out your sweet water (distilled water) system, and then thoroughly wash out by allowing water to pass through for about one hour before allowing it to go to the storage tank. This should be done about once a week until your trouble is corrected. Be very careful to use only the best cylinder oil, and as sparingly as possible. The taste and smell due to dirty boilers is frequently likened to creosote, which has a sort of a burned odor and bitter taste. We do not know of any special cloth, for use in filters, but the International Filter Co., Chicago, Ill., furnishes a special cloth for use in its filters, and by writing them they may be able to give you information along this line. W. H. Beisley.

Steam Line Queries

I HAVE a pipe line 4 in. diameter, 175 ft. long, about 12 ft. above the ground, connecting an engine and boiler. Steam pressure carried is 90 lb.; boiler capacity, 90 hp.; engine, 60 hp.; boiler opening is 3 ft. 6 in. higher than the top of throttle valve of plain slide valve engine.

Which end of line should have highest elevation?

Where should I place the expansion joint?

Where should I place steam trap, or is it necessary?

How much power will I lose? The line is to be covered. J. E. G.

A. The line should slope from the boiler towards the engine. The reason for this is that even with considerable up-hill the rush of the steam will carry whatever moisture is in the pipe along with it, and it is better to slope the pipe so that it will drain the direction of this steam flow; then at the engine a good sized separator should be put in, drained by a steam trap so as to remove all moisture before the steam goes to the engine.

With as long a run of pipe as you have, it would be best to put in a separator for a size larger pipe, that is, you are running a 4-in. pipe, put in a 5-in. separator. As to the expansion joint, it is best to put this in the middle of the pipe line and anchor the line at each end. This allows the expansion joint to take care of the entire length of the run with the least movement at any point in the line, and also enables you to make fast the ends of the line where they join the boiler fittings and the separator, thus guarding against movement at these joints, which would be likely to cause leakage troubles.

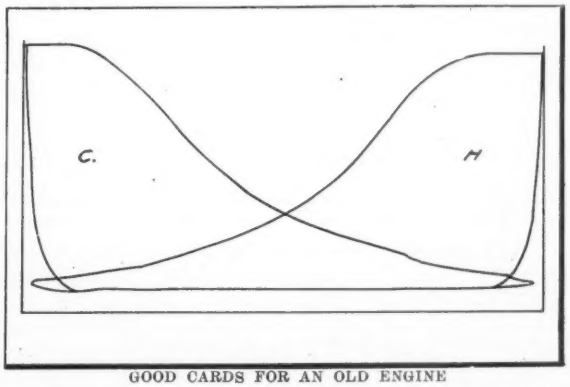
As to the horsepower you will lose, this depends somewhat on the kind of covering. The 85 per cent magnesia covering is recognized as the best material. The pipe surface on your line would be 206 sq. ft. and at 90 lb. boiler pressure the temperature difference between that and an average temperature of the air of 50 degrees would be 281 degrees. The loss for piping covered with magnesia is 0.465 B.t.u. per hour per square foot of pipe surface per degree temperature difference. Multiplying the 0.465 by 281 and by 206 gives us 26,920 B.t.u. lost per hour. The B.t.u. for one horsepower is found by multiplying 33,000 by 60 to get the total foot pounds per hour, and dividing 778, the number of foot pounds to a heat unit, by 2545. Dividing 26,920 by 2545 gives 10.57 hp. loss in the line.

Of course, if you use, as you probably will, extra covering on this line, because of its exposed position, it will cut down this heat loss. The calculation given is for ordinary pipe covering as used on lines inside a plant. A. L. R.

Cards from an Old Engine

KINDLY give me the i.h.p. and tell me in your opinion what to do to better the economy and quiet running of a Putnam engine, 15 in. by 36 in. stroke, 75 r.p.m. Boiler pressure is 80 lb. Accompanying card was taken from the high-pressure cylinder. The engine is 21 years old. O. A. T.

A. There is just one thing that you can do to increase the economy of your engine, and that is to reduce the back pressure if it is a possible thing to do so, as it is now about 6 lb. according to the card submitted.



GOOD CARDS FOR AN OLD ENGINE

Outside of that, for general results it is one of the best cards that has come under our notice as far as adjustment is concerned. The m.e.p. is exactly 28 lb. on each end and the card shows 67.5 i.h.p. and a steam consumption of 28.55 lb. per hp. hr., which is remarkable for an engine 21 years old, and the engine is a good steam saver.

We venture to say that if the engine has received the same care in all its adjustments that it has as far as valve adjustment is concerned, that it is a quiet running engine, and will give efficient service for many years yet if not pushed beyond its capacity.

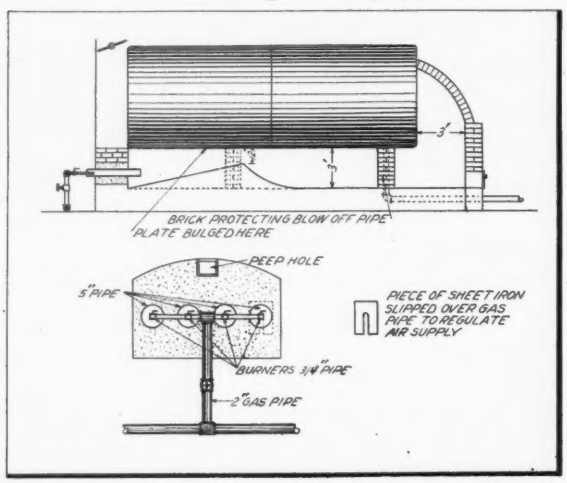
G. H. Wallace.

Trouble with Gas Firing

CAN you inform me of the best arrangement for firing boilers with natural gas? In a plant I have just taken charge of here there are 3 horizontal return tube boilers, 72 in. in diameter by 18 ft. long and rated at 150 hp. each. These boilers are fired with gas, the arrangement of the setting and burners are shown in the sketch. There was originally a bridge pierced with holes built close up to the shell, shown dotted in sketch. The boiler inspector ordered this pulled down, and built the present way, as the plates were bulged about ¼ in. in one place owing to the gas being deflected on that particular spot mostly by the bridge.

With the bridge they could keep up steam with 2 boilers, but with the present arrangement we can hardly manage with the 3 boilers in use. This gives me very little chance to repair them, as the plant runs night and day from Sunday 11 p.m. to Sunday 6 a.m. There is no firebrick in the setting. All the tubes are leaking, the walls are crumbling to pieces and on some parts of the shells and tubes there is ⅜ in. of scale, although the boilers have been in use less than a year.

The fire door is plastered up, a small space being left at the top to observe the fire. Four pieces of 5-in. pipe are fastened in the plaster. The 4 gas burners, pieces of ¾-in. pipe, go into the large pipes about 6 in. The air is drawn in through the large pipes.



DETAILS OF BOILER AND ARRANGEMENT OF GAS BURNERS

As far as I can learn the gas should burn with a clear blue flame, but with the existing arrangement I get a white flame. I believe that as there is nothing for the gas and the air to strike so that they will unite and ignite, that a great deal of the gas passes through unburnt. The pressure of gas in the main is 60 lb. If you could give me any enlightenment on this question I would be much obliged. A. H.

A. As you show in sketch, the setting, together with 4 ¾-in. burners, should give heat in excess of what is required for 150 hp. boilers with the gas working under a head of 60 lb. The fact of there being ⅜-in. scale is a considerable reason for the boiler not getting up to rating at the present time, but we understand that the accumulation of this scale was due to the fact that it has been necessary to push the boilers very hard and thus give little time for cleaning.

We think that somewhat better mixture would be obtained if a portion of the air was introduced where the grate bars usually are, through checker work of fire brick. If the floor under the boiler instead of being a straight line from the top of the bridge back to the burners was made concave and the burners tipped so as to throw the flame downward at a small angle, it would give a rolling motion to the flame and provide a better mixture. The fact that the brick is crumbling away indicates that you are getting considerable heat and it may be that much more steam is being used than you think.

We would advise getting some check on the amount of water which is being evaporated in the boiler. This, of course, could be done with a meter, but assuming that you have no meter it may be possible to measure the water in the hot well for a period of time or pump from barrels or other tanks for a short period of time and calculate the amount of water the pump handles per stroke at the speed which you are accustomed to running it.

Regarding the bagging of the plates, it may be necessary to move the highest point of the bridge further back in the experiments with the concave bed to prevent localizing a hot flame at the bagged point. The deposit of scale should be attended to by using a proper compound, purifying the water or using a proper feed water heater to deposit the scale.

Paul M. Chamberlain.

Length of Connecting Rod

I AM about to assume charge of an engine minus a connecting rod. How can I determine the proper length of a new one? C. D. S.

A. To get the length of your connecting rod, measure the length of the crank from the center of the shaft to the center of the crankpin. Twice this will be the stroke of the engine. Shove the piston back until it strikes the head end of the cylinder. Make a mark opposite the forward end of the crosshead shoe, pull the piston forward until it strikes the crank end head and mark the forward end of the crosshead shoe. The distance between the 2 marks gives the length of the cylinder.

Set the crank on the forward dead center and measure the distance from the center of the crosshead pin to the center of the crankpin. The length of the connecting rod will be this distance plus half the clearance. The clearance total is found by subtracting the length of the stroke (twice the crank length) from the length of the cylinder as found from the 2 positions of the crosshead shoe. This connecting rod length is, of course, the length between centers of boxes, and after this is laid out, the boxes and their supports must be designed around these centers.

A. L. R.

Heating of Motor Coils

WE have a single-phase induction motor, concentrated winding, and should like to know what makes one of the coils smoke. The motor is ¼ hp. and is directly connected to a forge fan, 60 cycles. F. H.

A. The cause of the heating of one of the coils in your motor is probably due to a ground or partial short circuit. We would advise you to make a test with a magneto to ascertain if there is any connection between the coils and the frame of the machine.

If you can send us the name of the maker of the motor, we can probably give you more information.

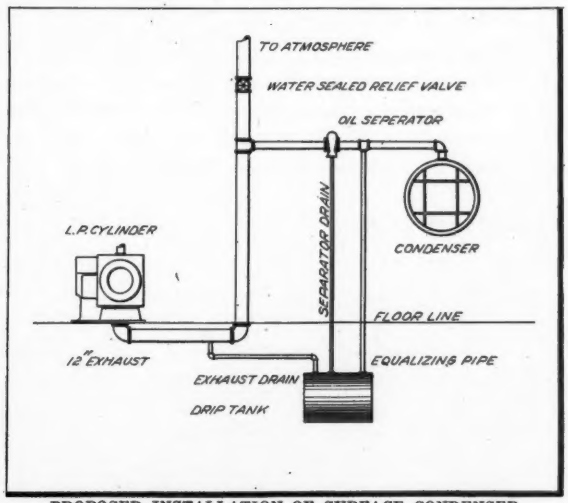
N. G. M.

Problems For Discussion By Readers

What Would You Do If You Had These Conditions To Meet?

Surface Condenser Installation

IN the accompanying figure is shown a proposed installation of a surface condenser, and I should like to ask the opinion of the readers regarding it. You will note that the condenser, which is mounted over a combined air and circulating pump, is located in the engine room, and is slightly higher than the low-pressure cylinder. A drip tank is to be installed in a pit beneath the engine room floor. The drain from the



PROPOSED INSTALLATION OF SURFACE CONDENSER

lower horizontal part of the exhaust pipe, and the drain from the vacuum oil separator is to be led into this tank, which will be fitted with the usual equalizing pipe, alarm, blowoff, etc.

Are there any objections to placing this condenser as shown, instead of in a pit below the engine room floor? R. H. R.

Specific Gravity of Brine

I ENCOUNTERED a proposition a short time ago that I do not understand, and one on which I would like to have the opinions of the readers of Practical Engineer. The brine in our ice can tank became weak and we were putting in some calcium while the machine was in operation. I placed the hydrometer in the tank and noted the specific gravity. Then, as I wished to take the specific gravity at 60 deg., I dipped up some brine in a clean one-gallon measure and was surprised to find that when I placed the hydrometer in the measure, immediately after taking it out of the tank, that the specific gravity was 0.009 lower than in the tank. I tried several times with the same results. Then I got other vessels of various sizes and found that no 2 showed the same specific gravity with all at the same temperature. The results of the test were as follows:

Brine in tank at 18 deg. F., sp. gr. 1.196.

In bucket 810 cu. in. 18 deg. F., sp. gr. 1.192, at 60 deg. F., 1.185.

In 1-gal. measure, 225 cu. in., 18 deg. F., sp. gr. 1.187, at 60 deg. F., 1.180.

In square can, 200 cu. in., 18 deg. F., sp. gr. 1.185, at 60 deg. F., 1.179.

I can understand why the specific gravity is different at 18 deg. than at 60 deg., but what puzzles me is, why is the specific gravity of a sample of 810 cu. in. higher than that of a sample of 200 cu. in., and that in the tank showing higher yet.

Does the specific gravity change with the volume as with the temperature? And if so, of what volume and area should the sample be to show the proper specific gravity? With brine so weak that at 12 deg. ice would form on the coils, making them 4 in. in diameter instead of 1¼ in., what per cent of loss is there due to the insulating effect of the ice?

In the above noted test the square can, measure and bucket were all about the same depth, the difference in volume being due to the difference in area.

I would be pleased to read the answers of various engineers in an early issue J. C. Hawkins.

Mean Effective Pressure; Valve Questions

REFERRING to your answer to L. E. on page 378 of the issue of April 1st, would say that the second paragraph contradicts the first. When ascertaining the mean effective pressure from an indicator diagram, the average length of the ordinates from the back pressure line to the steam and expansion lines is taken into consideration, and it makes no difference whether the diagram is from a condensing or a non-condensing engine. The position of the vacuum line has no bearing whatever on the subject.

In your answer No. 1 to D. J. H., on page 380 of the issue of April 1st, you say, "You can't alter the engine clearance." This is a mistaken idea, because it is an easy matter to alter the clearance of an engine. Sometime ago I had charge of an engine in which the clearance was excessive at the head end. I made a circular pattern and had a casting made from it. This was turned in a lathe to fit the cylinder where it projected into the counter-bore. It was securely fastened to the cylinder head by screws, thus reducing the clearance and saving more or less steam.

Having finished erecting one of the engines in my present plant, I attempted to turn the crank past the inside center but it could not be done, because the piston struck the cylinder head. This head was removed, put in a lathe and ⅛ inch turned off from it, thus increasing the clearance on the head end. This engine has been in operation for several years and gives entire satisfaction.

W. H. Wakeman.

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OIL ENGINE PROGRESS

Gasoline continues its upward way, and the automobilist is correspondingly saddened. Where, but a few years ago, gasoline was a byproduct and kerosene was the main profit maker, by the onward march of the motor-driven;—tractors, boats, cars, trucks, small lighting plants—the order is reversed, and kerosene now at 4 and 5 cents a gallon, to say nothing of crudes and distillates, form the cheap source of moderate sized power.

For high grade kerosenes with low flash point, successful engines in small powers have long been made by several manufacturers. The Diesel engine has proved beyond question its ability to handle heavy oils satisfactorily and produce power at low cost. Now 2 new types of oil engines are claiming place, the 2-cycle Diesel type at 400 lb. compression with built in compressor, and the "cold carburetion" type with no preheating of the fuel.

These changes, and the general activity in the line of oil engine improvement, indicate a line of development which should have the careful attention of engineers who need units of moderate power for regular service or intermittent peak loads.

SYNCHRONIZING

Synchronizing alternators and rotary converters is one of the most perplexing operations in power plant practice and requires great care on the part of the most experienced engineers. There are 2 essential requisites when throwing the incoming machine into circuit; the busbar voltage and that of the machine about to be connected to the busbars must correspond and the frequencies coincide.

Coincidence of frequency was, in the early days, determined by the use of incandescent lamps, the lamps indicating synchronism by remaining dark or light, whichever method was preferred. This method is still used, but is being largely superseded by the synchroscope, an indicating instrument, which shows whether the incoming machine is running too fast or too slow, and also indicates when the incoming machine is in step.

In this issue of Practical Engineer appears the first of 2 articles on the subject of synchronizing. It points out the analogy between the action of d.c. and a.c. generators when operating in parallel and illustrates by means of diagrams the various relations of frequency and voltage between 2 alternators, one of which is running and the other being started up. The effect of power factor, one of the "Bugbears" of a transmission system, is also considered and its effect upon an alternating current generator explained.

Material contained in this and the succeeding article should make clear to the readers any features of synchronizing which they have not heretofore understood.

NEW JERSEY STATE CONVENTION

The Big Exhibit and Gathering at Newark, May 30-June 2

BETTER AND BETTER each year is the verdict of those who were fortunate enough to attend the big exhibit and enthusiastic meetings held in Newark, May 30 to June 2. Over 100 exhibitors occupied handsomely decorated and interestingly filled booths for the period of a 4 day exhibit, and a large attendance of delegates and visitors rewarded them well for their trouble. The fact that the engineers of the city carried through an exhibit which was larger and more attractive than the Industrial Exhibit which the Newark Board of Trade recently held is cause for congratulation to both managers and exhibitors.

Convention Meetings

WHILE the exhibit was opened on Thursday, the convention meetings began on Saturday afternoon and lasted through Saturday and Sunday. The opening of the convention by President W. Krause, showed nearly the full roster of delegates present, and after reading of letters of regret from National Secretary Raven and Vice-President McGrath, the President's annual report was presented.

This told of a visit to every association in the State during the year, and the recommendation that in future the State Association should defray the President's traveling expenses for such visits. Also a recommendation that a definite list of lecturers be arranged, and means arranged by a per capita tax to pay expenses of such lecturers so that their presence may be assured at the times advertised. He gave much praise to the group of entertainers furnished by the Supply Men to visit the different associations with the President and Visiting Committee, and gave to them credit for the large attendance at the meetings. He believed that although the license law was defeated last winter, work on it should be continued and that the State's Deputy could do a large amount of work in increasing the membership in the associations throughout the state and in organizing new associations. He recommended a committe on eulogy of deceased members to report each year following the roll call, the names of those who have passed away, and to give some brief obituary and tribute to the deceased engineers.

Following this report, W. J. Reynolds, Past National President, congratulated the delegates on the state convention and the progress made which was a credit to Newark as well as to the Association. He believed that the state convention should be left in Newark as this was the biggest and best manufacturing city in the state and the best exhibit results could be obtained there. The convention was the best he had ever seen and he believed was the best state convention which would be held this year, but New Jersey must advertise and hustle in order to bring up the membership of its associations to what it ought to be.

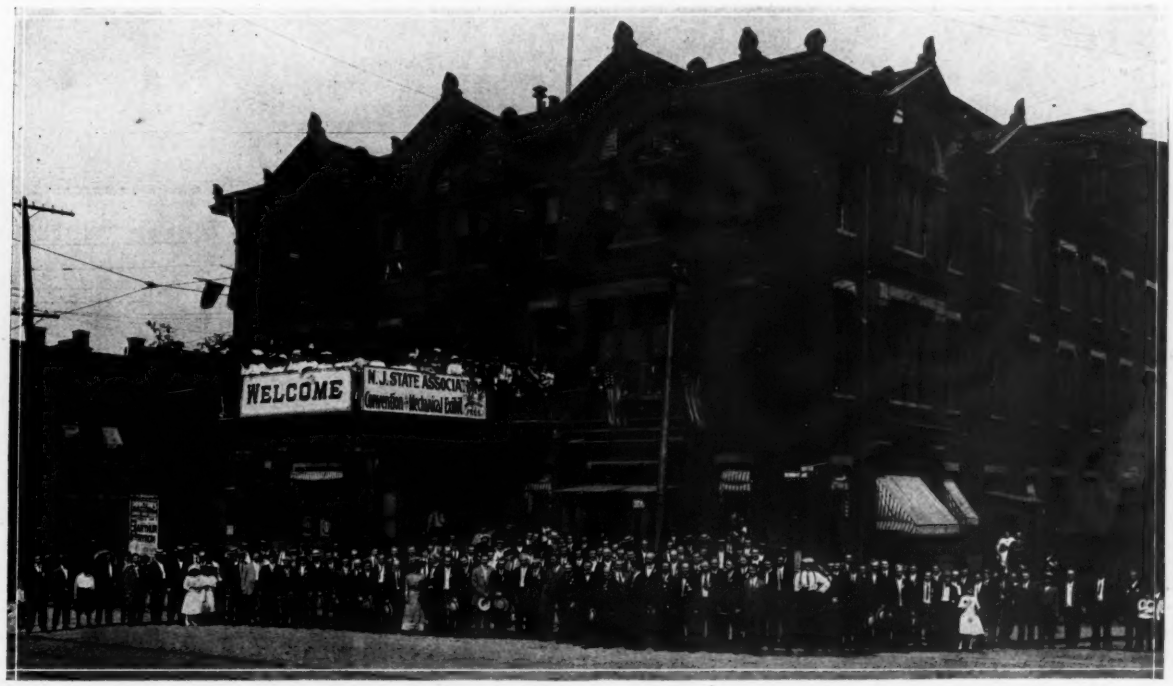


FIG. 1. DELEGATES AND VISITORS AT NEWARK CONVENTION HALL

He reported an increase in the income of the National Association and stated that this could be used either for extension of education or for the reduction of the per capita tax; he favored the latter course. He believed that in time the national conventions would come to be meetings of the delegates from the state associations, but the time is not ready yet.

Secretary Chas. W. Summer, in his report, stated

that all subordinate associations of the state, 11 in number, are members of the state association, and that a substantial balance is on hand in the treasury. J. D. Taylor, Secy., of the Life and Accident Department, told of the benefits to be secured from membership in this department, namely the payment of $500 at death or for an accident which involves a total disability. The yearly cost is only about $5.87 average, and the department is deserving of a larger membership.

J. R. Coe, president of the New York State Association and Deputy National Vice-President for New York State, said that the members depend too much upon the officers to do the work of the association. The members must also work in order to increase the membership, and should take a hand in visiting sister associations, and it would be well to take along a band of musicians or entertainers in order to bring out the attendance. He stated that the license law had been blocked both in New Jersey and New York by corporation influence, but that engineers can afford to work hard for license, and he gave an instance where the passage of a city license ordinance bettered the condition of the engineer on a 400 ton ice plant by $14 a week.

Mrs. Parrison told of the work of the Ladies' Auxiliary in not only helping aged and injured engineers, but in working for social intercourse and pleasant evenings and outings for the members of the association. She urged the organization of additional auxiliaries to help in the work.

A. L. Case, chairman of the License Committee told of the failure to pass the mandatory bill and the substitution of an enabling bill permitting cities to adopt license ordinances. He also told how Senator Hand arbitrarily killed the bill in his committee, although other members of the committee were favorable and the president of the senate was favorable to the bill. Most unusual was the report that of the money collected for the expense in pushing the license law, 18 per cent was returned to those who contributed, showing strong support, and good management. Mr. Case was of the opinion that the law must come by demanding an expression from governor and members of the legislature before supporting them for election of their attitude toward the license law.

State Deputy J. T. Jenkinson reported that during the year the associations had increased from 11 to 12, and the members from 822 to 875; J. J. Reddy reported for the Educational Committee that 72 per cent of the lectures planned were delivered, and that the chief difficulty was in providing for the expenses of lecturers so that they would be on hand as promised. He advocated provision for paying such traveling expense. Certain amendments to the constitution were proposed, one in regard to the method of making amendments, another increasing the delegates so that there would be one for each 10 members instead of one for each 15.

Complying with a request of the Manhattan Association, J. R. Coe of New York, was endorsed as a candidate for national vice-president at the Kansas City Convention.

The Feast

AT the evening banquet some 400 delegates, visitors and ladies were seated and after an excellent dinner the speaking was continued until a late hour but was all so interesting that most of those in attendance stayed until the end. Perhaps the most notable speeches were those of Judge Robert Carey, which made a strong appeal for interest by engineers in the affairs of government, for an optimistic outlook on the future, and for mutual co-operation for the development of the individual which would mean the greatest degree of progress; also the speech of F. R. Low, who dealt on the incentive to progress which is gained by association of engineers with each other and study for mutual helpfulness. Other speakers were Past National President, J. F. Carney, who acted as toastmaster, Past National President W. J. Reynolds, National President E. H. Kearney, C. H. Burnett of Newark Board of Trade, J. H. Donnelly, president of the Common Council, J. A. Coe, State Deputy for New York, G. W. Knight, Chief Engineer of the Public Schools, and Wm. Krause, President of the New Jersey State Association.

In Memory

AT the meeting on June 2nd, J. J. Callahan, Chairman of the Memorial Committee gave an eloquent eulogy on the lives of departed members at which all stood in silence in commemoration of those who had gone before. National President Kearney congratulated the convention on its success, which was the best so far seen, and hoped that Massachusetts or New York might go ahead so as to keep up the rivalry. He told of the work done through the year, of the institution of an educational board, in charge of educational matters, and made up of Professors Miller and Riley of the Massachusetts Institute of Technology, Professor Gebhardt of Armour Institute, and John Lane, editor of the National Engineer; also of the institution of an information bureau conducted by Professor Riley. He advocated the doing of detail work by the state associations, and that prizes be offered for the best educational work at the state convention, and emphasized the value of speeches by civic authorities at the conventions.

Passing to the business of the day, it was voted to make the per capita tax 25 cents and that $125 be allowed the educational committee for expense, and that the expenses of the visiting committee be paid. Also that a memorial exercise follow the roll call of each convention.

A gavel was presented to the State Association by Hoboken Association No. 1, and it was voted to present past president jewels to those state officers who have not already been supplied.

New Officers

ELECTION of officers then resulted as follows: President, Martin J. Hickey, of Jersey City; Vice President, John T. Jenkinson, of Patterson; Treasurer, G. A. Brown of Newark; Secretary, Chas. W. Summer of Hoboken; Conductor, Jas. S. Heath of Elizabeth; Doorkeeper, Wm. Brown of Jersey City; State Deputy, John T. Jenkinson.

After some discussion it was voted that the 1913 convention be held in Newark, and that a member from each association be named by the president to assist in the work of preparing for the convention if the local committee should ask for it. The usual resolutions of thanks were passed to the local committee, to the city officers, to the Supplymen's Association, and to the proprietor of the hall; and the Life and Accident Department was heartily endorsed.

The afternoon was spent in visits to various power plants in the city and by some of the delegates in studying the exhibits in the hall below.

What You Saw

WHETHER YOU ARE FROM Missouri or not, the big show case full of packings, including the Lip hydraulic packing, Regina sheet, and twist, molded gaskets and other forms showed conclusively the big line of the Crandall Packing Co., and the variety of its products. W. T. Cashell was representative, and assisting him to explain the operation of the Roto boiler tube cleaner, which is handled by the Crandall Co., Mr. Theo Kalisher.

"TISAFINE"; how with such a name could a packing for a pump plunger dare to show other than good results? And the Dichtungsgummi sheet and Silver Fox ammonia, with the Rivalate Metallic made up a strong exhibition for the Strong Machinery & Supply Co. The representatives were A. D. Currie, Elmer K. Cunningham, Lewis E. Strong, John C. Arrison and Leonard Lyon.

MADE UP of small replacable sections yet arranged to shake or dump as a whole, was the characteristic of the Coe shaking grate which was illustrated by a full sized section in charge of Allan Coe and C. T. Coe, representing the C. T. Coe Co. The advantage of the replacable surface is obvious.

A BIG BOARD full of big gages aptly represented the big business and big ideas of the Schaeffer & Budenberg Mfg. Co. Besides the gages, which were of recording and indicating types, there are thermometers and tachometers and the specially designed outside spring indicator for gas engines and the Diesel oil engine. In charge were E. K. Uebe and A. W. Humm.

and piston motion operated by a motor and shown in action by Hewes & Phillips Iron Co. The valve gear was of the Franklin gravity latch releasing Corliss type and was full size. Besides descriptions of this gear, catalogs explaining the Naylor Vortex turbine steam separator were distributed. Franklin Phillips, president; D. Drake, superintendent, and A. F. Freiler were at the convention.

CONDULETS, Jandos fans, D. & W. enclosed fuses and fuse blocks, and Hubbell porcelain specialties filled the space of the Newark Electric Supply Co., in charge of L. E. Hall and J. J. Feiner.

THE LIPPINCOTT indicator with reducing wheel and cord take-up made a strong contrast to the old style nonreducing motion "indicator of our daddies," in the booth of the Lippincott Steam Specialty & Supply Co. A. J. Lippincott, the inventor of the indicator, was present to explain its workings, assisted by Mr. Hill. Photographs and descriptive matter of the Keeler boiler made by E. Keeler & Co., were also shown in this exhibit.

FIRST AID to the elevator was shown by the Otis Elevator Co. in the form of cup leather packings to prevent leakage and lubricants for plungers and guides to alleviate friction. The goods were displayed on a large rack which well set off the product and were in charge of Jos. W. Greves, John Keenan and Wm. Starkweather.

"HOW MUCH STEAM goes through that pipe," was the question which could be answered by the General Electric Co.'s steam flow meter shown in a bower of palms and with easy chairs inviting to rest while the meter was explained by Chas. Hewson and J. W. Moran. Other products of the General Electric Co.

FIG. 2. VIEW IN THE EXHIBIT HALL AT NEWARK

"FLOATING IN OIL" was the legend conveyed by the air bubbles as they rose through the tubes in the cabinet of the Standard Oil Co., and attracted the attention of visitors to the products of this firm, Arctic cup greases, Premier bearing greases and oils of all grades exhibited by sample bottles. The story of oil was told by the representatives, A. R. Talcott and C. E. Barnes.

A BRAND NEW SHEET of a new brand of packing, Genarco, attracted attention at the booth of Jenkins Bros. There was the usual display of Jenkins valves and valve disks, tubular and molded gaskets and other noted steam specialties. Two booklets, "Engineer's Joints" and "Pause and Reflect," told why the engineer ought to know Jenkins Bros. and their product. Representatives were Frank Martin, F. J. Murphy, C. B. Ohlsen and Joe McKenna.

CONSOLCO SHEET backed up Consolidated Rubber Core Ring Packing to form an eye-holding effect for the exhibit of the Consolidated Packing & Supply Co. To complete the trio was the Adamite high pressure sheet packing and to do the honors F. E. Ring.

THE TEMPLE OF OIL made up of cylinder columns of the oil sample flasks which supported a gable of barrel ends made a unique setting for the exhibit of the American Oil & Supply Co. This included Crescent engine and valve oils, Perfection auto oil and other brands for various purposes. Members of the company present were H. V. H. Snyder, president; John L. Carrol, vice-president; W. F. Hoffman, treasurer, and C. R. Burnett, secretary.

THE ENVY of association lecturers was the model of valve were fully described by the complete files of bulletins which were available at the booth.

INSURE your heating system, was the warning given by Warren Webster Co., the means provided being the Webster modulation system for keeping up the heating efficiency and keeping down the pressure. One of the smaller sizes of Webster Star Vacuum open heater was shown as well as the Webster separator for steam and oil and the special valves for control of radiators. S. J. Hammond, Howard Newman and Mr. Quackenboss emphasized the message.

"GACO" is not Italian for anything but it is just the other way of identifying gage cock, etc., made by the Pittsburgh Gage & Supply Co. The product of the company includes the White Star Oiling System, Sterling force feed oil pump, Pittsburgh separators, the R. K. exhaust head, and others. W. G. Ruggles was in charge.

NATIONAL ENGINEER was represented by Chas. F. Ceilley, eastern representative.

M. M. & M. is not a simile for a hum, but the initials of Manning, Maxwell & Moore, in whose exhibit the Ashcroft pop safety valve showed in section the details of its innermost thoughts and actions to those who would stop to learn. F. J. Corbett did the talking for it.

A FOUNTAIN OF PERFUME in a bower of palms and flowers invited the weary to share the welcome of J. W. Wilson in the space of the Dearborn Drug & Chemical W'ks while he explained to them the Dearborn treatment for boiler feed waters.

INDESTRUCTIBLE; a most desirable quality for a packing, as every engineer knows, and the name of the new brand of white

sheet exhibited at the booth of the New York Belting & Packing Co. In addition there was Cobbs high-pressure piston packing, Cobbs spiral packing for piston and valve rods, the Firo sheet packing for superheated steam, and Turxo valve stem packing. The exhibit was in charge of C. A. Wilhoft, Manager, F. N. Anderson and L. H. Young.

THE RAINBOW is always a thing of beauty and the Peerless Rainbow is no less desirable than the other Peerless products shown in the booth of the Peerless Rubber Mfg. Co., which was presided over by Chas. Heitzmann. Other products shown were Peerless pump valves, rubber tiling, spiral, round and square packings and flax braided. Assisting Mr. Heitzmann was W. S. Leonard.

REPRESENTATIVES of Power were F. R. Low, C. S. Dibble, H. J. Fyfe and Wm. Buxman.

THE WHOLE Rochester Force Feed family, little and big, all toeing the line and working together, was the impressive sight in the booth of Greene, Tweed & Co., in charge of A. C. Widman. On the other side of the booth Palmetto and Manhattan packings and the Favorite reversible ratchet wrench were displayed by Geo. R. Starrs.

THE QUALITY LASTS after price is forgotten, and R. D. Jackson, representative of the Philadelphia Grease Mfg. Co., called it the Quality Lubricant, with Horace A. Smith, treasurer of the company, who showed also the Jackson auto and crank-pin grease cups for utilizing the various grades of grease.

SHAKE THE Yingling grates. They shake easy, as was shown by C. Yingling, of C. Yingling & Sons, who exhibited a full sized grate in working order.

IF THE VALVE ROD HAS Shredded Wheat (packing), otherwise known as Buhne metallic packing, for breakfast, it will be satisfied. Just pick it up and serve it into the stuffing box and it will take care of itself. This was the story told and illustrated by C. L. Johnson in the booth of the Buhne Metallic Packing Co.

IT IS IN THE VALVE of the new Model D that the great advantage lies. That is why the V. D. Anderson Co. made a special exhibit in section of its new Model D trap with the valve parts so displayed that their operation could be seen. H. S. Meacham and L. A. Couch explained the operations.

GREDAG, OILDAG AND AQUADAG and the high temperature electic furnace which uses 2000 hp. of energy and bakes at 7500 deg. F. that makes them possible were shown by G. M. Barnes and H. E. Poeller, with samples of the various grades of lubricants for different purposes in the space of the International Acheson Graphite Co.

REBORING CYLINDERS is easy by the Underwood method, as shown at the booth of H. B. Underwood & Co., by means of its cylinder boring machine. Other specialties were the Improved Corliss dashpot, the special steam packing for pistons and the ammonia compressor valve. H. Griffith and W. Luckensmeyer were the representatives.

AS A CORNER STONE a speciment of the Curtis steam trap was utilized by Boig & Hill in their exhibit. This included many other steam specialties bearing the Curtis trade mark and made by Julian d'Este Co., also the Everlasting blowoff valve from the Scully Steel & Iron Co., the Watts boiler feed regulator with full connections to show just how it works. Representatives were W. W. Boig, W. T. Hill and J. W. Newman.

TALL AND SHORT BOTTLES of oil in imposing array, and masses of Viscos grease in cans demonstrated the product of the National Oil & Supply Co. in charge of Arthur Phillips, president, and Mr. Rudd.

AS THE NAME WAS MEANT to imply, the Cinch expansion bolt is easy to use. Arranged in all sizes, in circles and lines and triangles, they caught the eye in the booth of the Cinch Expansion Bolt & Engineering Co., in charge of G. Rohmer.

IT WOULD HAVE STOPPED an engine, working just as it did in the exhibit, that Strong engine stop made by the Strong, Carlisle & Hammond Co. They showed many other specialties, including the vacuum trap, regulating valve, etc. The representatives were A. B. Pinney and L. W. Pinney.

THE CORKSCREW COILS of the Reilly multicoil heater always attract attention and make an interesting study, with their provision for large heating surface and expansion. Other specialties shown by the Griscom-Spencer Co., were the Bundy separators for steam and oil, the Bundy tilting steam trap, the Goubert feed-water heaters, Stratton separators. In charge were S. S. Schaeffer, W. J. Hart and F. F. Gott, Jr.

BENDS, COILS AND HEADERS made a striking background for the line of specialties and devices exhibited by the John Simmons Co. Bends and coils came from Simmons Pipe Bending Works, while the other specialties came from the company's selling branch. These included Simplex blowoff valves and pipe clamps, Marsh valves, which are quick operating, coming wide open on 2½ turns and can be packed under pressure, Kewanee unions and elbows made by the National Tube Co., the Van Stone joint, the Sterling steam trap, Rothschild blowoff valve, the Beaver die stock. The representatives were A. R. Milne, Jr., F. Sonnekalb, and J. D. McInerney.

YOU KNEW IT by the red keystone on the blue can. "Keystone Grease, a grade for every purpose." Two big pillars of cans and two little pyramids in the center, all with the same mark, emphasized this point. H. B. Coleman and J. M. Potts presided.

IF IT'S A BRASS steam specialty, Lunkenheimer has it, and the exhibit went a long ways to prove it. It included globe valves and gate valves, angle valves and check valves, brass valves and iron valves, and valves that were just valves; also whistles, lubricators, manifolds, etc. The representatives were J. E. Cooper and W. A. Reynolds.

GARLOCK NUMBERS are styles. Number 900 is White Fibrous Sheet, No. 22 is Red Gum Sheet, and so on down the list, but the Beaver Twist Self-Lubricating has a name of its own instead of a number. These were all seen under the control of E. C. Horn and W. S. Elberson at the booth of the Garlock Packing Co.

"ALL LUBRICANT, No Waste," was the legend above the yellow cans of the Albany Lubricating Co. Their war cry was "Death to Friction," the weapons being Albany Grease in the yellow cans and Auto Transmission Lubricant in the green. Whether you put your money on the yellow or on the green you win. Representatives were M. V. Peavey and Jos. Sheer.

CRANETILT; a tilting trap made by the Crane Co. The main feature of the exhibit was 3 of these full sized traps in actual operation, showing the sensitiveness and tightness of the action. A stream of water furnished by an electric pump and compressed air from an air compressor took the place of the ordinary condensation and steam of a steam system. Other specialties were Klingerit packing for superheated steam, large pipe bends, pressure regulators and separators. The representatives were E. Sink in charge, W. Oswald exhibiting the traps, and C. Roe showing the C. C. pressure regulator.

IT CLEANS OIL CLEAN. The Cross oil filter made by the Burt Mfg. Co., and other specialties help also to save oil. These were shown in the booth of Ludlow & Squier, in charge of W. J. Morrow, and in the same booth were shown the line of Dodge wood and iron split pulleys, Beaver die stocks, Jefferson unions, Federalite Metallic packing and valves made by Jenkins Bros. and by the Lunkenheimer Co.

FIVE THOUSAND POUNDS is not too high pressure for the Homestead valve to carry, if it is designed for that purpose. Made by the Homestead Valve Co., these were shown in sizes from big to little, connected in series and in manifold. They were shown as straight way, 3-way, 4-way and acid valves, and were seen in the combination booth of Homestead Valve Co., and the C. E. Squires Co., which was in charge of Frank Boyle and J. G. Boyer, the latter representing specially the Squires Co. Even air does not get by the Squires trap, as was shown by a working model which shut off when operating under air pressure without letting any air escape and would stay shut off so that the pressure inside the trap did not drop.

DURABLA GAGE GLASSES, resting as befitted their high rank on a royal velvet throne, were shown in the Pitts & Kitts Mfg. & Supply Co. exhibit. Perolin from Germany kept the Durabla glasses company and other lines shown were the steam specialties of the Kitts Mfg. Co., including the 20th Century steam trap and separator, Kitts feed-water regulator, McCord lubricators and the McKim gaskets, reducing valves made by the Ohio Brass Co., Paterson-Allen forged steel valves which are put into the main line with flanges and may be arranged with the valve stem in any position, the Everlasting blowoff valve and Durabla high-pressure steam packing. Representing the different interests were Wm. S. Pitts and Willard A. Kitts, Jr., of the Pitts & Kitts Mfg. & Supply Co., Jack Carson and N. P. Hill, of J. G. Von Kokeritz & Co., representing the Durabla specialties.

MADE IN BOSTON and made by Ashton were 2 attributes of the specialties shown in the exhibit of the Ashton Valve Co., which included the Ashton pop safety valve, showing by sectioned model the special construction, the Ashton improved blowoff valve, deadweight gage tester, recording and indicating gages, whistles, relief valves and other brass goods. Representatives were C. W. Ulrick and C. W. Buckelew.

CARRIED ON A CHAIN and forming a most effective grate surface were the Crowe grate bars exhibited by the Iron Works Co., represented by J. Edgar Jones.

HELPED QUICKLY is helped twice, hence the ability of Crane & Milligan to supply from its large stock of specialties anything needed in the steam plant was appreciated and was well illustrated by the display of Beaver die stocks, Phillips pressed steel pulleys, Ashton steam specialties, Jenkins valves, Diamond expansion bolts, J. H. Williams Co.'s chain vise and wrenches,

Eureka packings, Eclipse gaskets, Stephenson Bar Belt Dressing, etc. The exhibit was in charge of S. J. Milligan and W. A. Gurbach.

ALWAYS READY and always used because it's easy and effective, were the arguments for the National Flue Cleaner made by the National Flue Cleaner Co., of Trenton, N. J. The cleaner is arranged as a permanent attachment at the front of the boiler, with a nozzle opposite each tube and controlled by a handle convenient to the hand of the fireman, all points in its favor. H. R. Straus, Otto Donatz and Richard Bate demonstrated the apparatus.

IT IS THE AGE of applying science to secure results, and "may work" won't do. That's why the methods of the W. B. McVicker Co., manufacturers of scientific boiler compounds, were found interesting by delegates. High grade lubricants including Hydroleum elevator lubricant, are also among the company's products. W. B. McVicker, president of the company, was present, also John J. McDonald, of Phoenix Association No. 24.

SAVING HEAT means saving cash, and heaters and pumps can easily do both if they are right. Pumps of the M. T. Davidson Co. and the Cochrane heaters of the Harrison Safety Boiler Works were exhibited in a joint display under the supervision of F. E. Idell, New York agent for both lines, Wm. E. Brennan, of the Davidson Co., and W. W. Montalvo, Jr., of the Harrison Safety Boiler Works.

VESUVIUS COULDN'T BLOW OUT N. B. O. packing, or at any rate, so the book said which was distributed by the Home Rubber Co. through its representative, A. R. Foley, better known as Dick, who also showed the O. I. M. cushion packing for high and low pressure.

USE GOETZERITE and you'll guess right, was the argument of H. W. Bergmann & Co., agents for this packing, which is made by the American Goetze Mfg. Co. Other products of the same company are the Metallic Gasket and Packing, the Devo gaskets and Goetze No. 2 gaskets. Included in the exhibit were also the Swartwout ball bearing ventilators, cast iron exhaust heads, steam and oil sperators and safety water gages, with the legend that "Swartwout wins out." The Schade balanced float valve, pump control valve, and steam and water reducing valves were also shown. Representatives were H. W. Bergmann, E. N. Walton, of the Ohio Blower Co., and E. B. Lewis, of the Schade Mfg. Co.

THE LIFE of a suspension bridge is in the cables. What's good for a bridge is good for an elevator, therefore the convincing exhibit of John A. Roebling's Sons Co., showing one of the big bridges which it has built and which has endured for years, was of interest to engineers. W. Troescher was in charge.

ALL IN WHITE decorations and all with white labels was the appropriate arrangement of the cans of White Rose grease shown by Jas. W. Crane. Marine Cylinder Compounds and Crane's Vegetable Extract Boiler Compound were also included. The representative was W. M. Crelin.

A COOL SPOT near the General Electric fan drew all who passed to a stop. This was one of the exhibits in the booth of Fletcher-Stanley Co., others being the Shelby Mazda lamps, H. T. Paiste Pipe Taplets, the Sprague conduit and the Chicago Fuse Mfg. Co.'s union fuses and blocks. F. E. Bailey was in charge.

"EVERYBODY'S DOING IT" was the legend at the booth of the Foster Engineering Co., and in answer to the inevitable "What?" "Insisting on Foster Engineering Co.'s reducing and regulating valves," and the representative, W. C. Powell, showed why they should.

THIRTY-SEVEN VARIETIES of Ambest packing besides the Red Diamond Eureka packing and the Thompson Improved indicator made an interesting list of exhibits at the booth of the Eureka Packing Co., and Jas. L. Robertson & Sons, in charge of Frank Bloomer and Walter R. Bald.

SECTIONAL VIEWS of the Penberthy injector in horizontal and vertical types, both big and little, and of the Auto Cellar drainer were also shown.

"WATCH THAT BELT hang to the pulley!" was the exclamation of those passing the exhibit of Cling-Surface Co., and the model showed how Cling-Surface makes a belt pull by comparison of treated and untreated belt drives. A new specialty of this company is Erusa belt dressing in liquid form shown by Chas. F. Chase and C. N. Tillotson, the company's representatives. A model of the Haines automatic vent for vapor heating systems, made by W. S. Haines Co., was also seen in this space.

A BLOWER with its own steam turbine built in was the special feature in the booth of L. J. Wing Mfg. Co. This was the Typhoon blower for induced draft, and other specialties were the Watch Dog feed-water regulator, positive pressure Hypress blower for pressures up to 10 lb., and the disk ventilating fan. E. D. Fieux, president of the company, was at the convention, assisted by V. D. Carples and E. S. Grace.

WHEN IT TILTS the water goes and the steam stays. The Morehead trap shown by the Morehead Mfg. Co., represented by Ross & Taggart, demonstrated this point by its action. The trap also has the special feature for low-pressure systems of being a real condenser. Jas. M. Taggart represented the company and in the interests of the Vulcan Soot Cleaner Co. were also present C. D. Hoffman and Chas. De Ved.

MOLDED GASKETS were a feature of the Belmont collection of packings shown by Clement Restein & Co., in charge of G. W. Stewart. Others were the Belmont 1903 expansion packing and the Belmont stitched hydraulic.

THE STAR OF THE Powell team is the White Star valve, but the team includes a player for every position in the steam plant game, including the Disc and Model Star valves in both brass and iron, made as gate, globe and angle valves and as quick-acting, Cyclone blowoff valve, Titan throttle valve, and Trojan and Crescent lubricators. J. G. Zolleis was in charge of the team.

WHAT NEEDS PACKING? Johns-Manville has it, as proved by the Kearsarge ring and spiral, Permanite sheet, Liberty Red sheet, Kearsarge gaskets and other specialties, particularly the J. M. Sea-Rings, of which a large model was shown. Bare pipe is a waster and the J-M coverings are the remedy, a full line of these being displayed. The representatives were J. Beveridge, D. C. McClure and Wm. McElravey.

STEEL MIXTURE, true to its name, convenient to use and durable, was shown made into a Dutch oven furnace for return tube boiler sets. The blocks have a key to hold them true to position. Representatives of the McLeod & Henry Co., Manufacturers of Steel Mixture, were John H. Foote and F. V. Tuthill.

SMOOTH-ON IRON CEMENTS, and so they do, for there is a cement for every use, made with the right amount of expansion for the work. Besides the different grades of cements there was shown the Nos. 7 and 10 gaskets in big and little sizes and the properties of these cements and the savings made in repair work were explained by C. E. Googins.

"REASONABLE REASONING" and "A Question of Quality" were the titles of booklets showing why the forced-in bronze seats with protecting shoulders of the Webco unions, made by the Webb Mfg. Co., stay tight. F. B. Potterton was in charge.

THE BOTFIELD BAR is a dry proposition but can expand when things begin to get hot, because of the herringbone arrangement of the cross pieces and the free ends. A. B. Botfield exhibited these as well as Adamant and special fire brick for boiler furnaces.

THE BIG BRASS HEATER bends which make up the active element of the Seymour water heater reminded one of the small boy who said of the trombone player: "I don't see how he swallows it," but these bends went into the head of the shell and produced results. The exhibit was made by David C. Seymour, who also showed the Seymour shaking grate and a model of the Continental internally fired boiler.

"THE PILOT TO SUCCESS" was the watchword of the International Correspondence Schools, whose exhibit showed the instruction books, catalogs of courses and work of the students. The representatives were W. C. Braig, G. M. Johnson, J. E. Jackson, and R. L. Rank.

NORBENE OILS AND GREASES are to make life go easier, and Chas. Hicks, Jr., the representative of the Norbene Oil & Supply Co., explained how they do it.

FOR THE BROKEN BELT or to secure the new one, the Crescent fasteners, R. H. lace leather and Kerr's metallic lacings were displayed by Couse & Bolten, who showed also the C. & B. belt dressing and a hide illustrating the portion from which the C. & B. belts are taken.

HELP IN THE RUNNING might be obtained by either Taft and Teddy or Wilson and Champ if they used the Capital elevator guide lubricator which was discharged by the Mutual Supply Co., in charge of Clifford L. Bailey.

"DICKBELTS" which had been running in water 2 years were shown in the exhibit of R. & J. Dick Co., Ltd. Every belt guaranteed.

TO THE VICTORS belong the jobs of governing the draft, temperature and pressure of the systems on which they are installed. These devices were shown in operation in the booth of the Standard Regulator Co.

AN ARCH OF ARMOR fire brick to protect the boiler from over-heat was the display of the Greenpoint Fire Brick Co.

A COMPLETE LITTLE STOKER was that model of the Jones underfeed shown by J. V. Ryan and Mr. Barth, representing the Underfeed Stoker Co. of America. Decorating the booth were views of clean stacks showing the effectiveness of the stoker at work.

OIL MUST GO where you want it when pumped by the Hart mechanical force feed oiler made by the Sherwood Mfg. Co. and exhibited by J. H. Madden in 1, 2 and 3-feed types. The company showed also the Buffalo injector and hand pumps and oil cups on a pyramid rack. In the same space H. J. Marks, representative of the American Engine Co., told in "A Story Boiled Down" the merits of the Angle Compound type of engine.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Strength of Steel Tubes; Proportions of Cooling Reservoirs; Safety Valve Capacity

OPENING the convention on Thursday morning were papers dealing with Processes of Chilling Cast Iron and The Properties of Some Irons Used for Chilling, both papers presented by Thomas D. West. Experiments for determining the conditions producing an internal chill while keeping the outside of the casting soft were described. Also, the various methods of producing this effect and experiments as to the depth of chill which may be secured by different methods of handling the processes.

Some of the mediums used for producing the chill were air jets, water immersion, water in an air jet and a layer of powdered material such as charcoal or manganese through which air could circulate. Water, air and granular substances were found good and it was also found that for chilling by means of a piece of iron a heavy chill is better than a thin one; also that a long chill gives a deeper effect than a short one. Pouring the metal hot gives a deeper chill than pouring cool.

In order to be chillable, iron of ordinary grades should have not less than 2 per cent of silicon and over 0.06 per cent of sulphur. The conditions governing the internal chill are difficult to maintain and in the present state of practice are not absolutely certain. In the tests of chilled irons, it was found that, for castings chilled on one side only and subject to bending, the unchilled or gray side should be put in tension. It was found also that all chilled or white iron can be secured with strength 75 per cent of that of the gray iron, but that sections as nearly round as possible should be used in order to get crystals radiating from the center.

Strength of Tubes

RECORDING the results from a series of tests of tubes under internal pressure and discussing the different formulas that have been secured, Prof. R. T. Stewart gave as the result the following as best representing the results: These are different forms of the Barlow formula which has been in use for some time. Safe pressure = 2 times the safe fiber stress times the thickness of the metal in inches divided by the outside diameter in inches. The thickness for a given pressure = the diameter in inches times the pressure in pounds per square foot divided by 2 and by the fiber stress. To get fair values for the safe fiber stress divide the following values by the factor of safety; for butt-welded steel pipe, 40,000; for lap-welded steel pipe, 50,000; for seamless steel tubes 60,000; and for wrought iron pipe 28,000.

Surge Chambers and Water Wheel Speeds

NEXT on the program was a mathematical discussion by Prof. W. F. Durand as to the properties of surge chambers for high pressure hydraulic lines. No simple summary of the conclusions can be given as the author concluded that the only safe design rests on a study of the length, slope and coefficient of friction of the pipe line and on the variations of the load on the wheel.

On a similar subject Wm. F. Uhl discussed speed regulators for hydroelectric plants and how the variations of speed may be handled by the flywheel effect of the water wheel and armature, the use of a pressure regulator, the installation of a standpipe or reservoir, or the arrangement of bypass connection, or deflecting nozzles. The standpipe is more economical than the pressure regulator in the use of water, but often will be less economical in cost of plant. It is, however, difficult to make such a regulator which will take care of the increase of power in case the entire load is suddenly thrown on the generator unit.

Another scheme for reducing height of the standpipe is the provision of a water rheostat connected to the low tension bus bars with an oil switch and mechanical trip on the governor or grate mechanism so that in case of short circuit part of the load will be put on the water rheostat.

The standpipe or regulating reservoir is the most satisfactory method of control, but often the difficulty of locating it and the cost of construction are prohibitive. In a plant with a long penstock where the standpipe cannot be installed and the size of penstock cannot be increased on account of cost, sometimes sufficient flywheel effect cannot be introduced on the generator units to get satisfactory regulation. In such cases a bypass which will discharge such part of the full-load flow of water as is not required for the turbine at a given time must be provided. It is difficult to design a bypass that will do this, as the discharge from turbine gates is not proportional to the governor position from which the bypass must be operated. Also the coefficient of discharge of the bypass cannot be kept constant during the full range of opening. Pressure variations will, therefore, be quite considerable, sometimes as high as 25 per cent, but by careful design can be kept as low as 10 per cent. The bypass should always be brought as near as possible to the turbine gates and in line with the flow of water into them.

Deflecting nozzles are more generally used in case of impulse wheels, the stream being partially or fully deflected from the buckets as the load falls, the pressure remaining constant. The objections to both the bypass and the deflecting nozzle is their wastefulness of water.

In providing for speed regulators in small plants, frequently a load change of 100 per cent may occur where only one unit is running, but in larger plants it is seldom necessary to consider so great a change.

As to air chambers, this would seem an ideal means to provide against extreme pressure variations and the volumes required in cubic feet would equal the accelerating time in seconds multiplied by the velocity of water in the penstock in feet per second and divided by the allowable pressure variation. It will be found, however, that this usually calls for very large and expensive air chambers. Besides this, there is the constant danger that as water absorbs the air, the air chamber may become inoperative just at the time when it is most needed.

Steam Turbine Developments

THE first paper of Friday morning was a review of the present state of development of steam turbines by A. G. Christie, which will be abstracted at length later. In discussing this paper, C. G. De Laval stated that in large units the reaction turbine does not give as good economy as the impulse type, the reason being that the reaction wheel does not allow of practical blade speeds without too many rows of blades which necessitates long rotors and produces distortion troubles, especially with superheat.

He called attention to a new type of Parsons turbine, designed by Ljungstrom, which is giving remarkable results. The flow of steam is from center to circumference between 2 disks. These disks are arranged to revolve in opposite directions at the same speed, a generator being

driven by each disk. This gives a relative speed of blades twice that where one set is held stationary, and permits of using ¼ as many blade rows as in the other designs. The result is a small turbine, the dimensions for a 1000-hp. rotor being 27½ by 20 in.

A 500-kw. unit running at 3000 r.p.m. with steam at 175 lb. absolute, superheat of 250 deg. F. and a vacuum of 28½ in. showed a steam consumption of 8.75 lb. per brake hp. per hr. and an efficiency compared to the Rankine cycle of 71.8 per cent.

Designs have been prepared of the double rotating disk type from 1000 to 7500 kw. capacity and a single disk design operates satisfactorily, but with a steam consumption 10 per cent greater than the double-disk design.

Tests on a 1000-kw. machine at 3000 r.p.m. with steam at 162 lb. pressure showed a steam consumption of 8 lb. per brake hp. per hr. and of 11.65 per kw. per hr. The critical speed of this unit was 6300 r.p.m., so that the rotor does not pass through the critical speed in being brought into service.

The bottom of the turbine is seated on the condenser without expansion joint and is the only fixed support. The generators, one at each end, are mounted on springs on the extended ends of the condenser. The Parsons blades are milled from solid nickel steel, the disks being soft iron turned both inside and out. The 2 generators run in sychronism, but on occasion one may be fixed and the other disk used alone. For marine practice motors or gearing are used to reduce the speed for the propellers and it is possible to reduce the boiler capacity and the coal bunker space from 25 to 30 per cent.

Mr. J. A. Moyer, in his discussion, called attention to tests of the Sulzer turbine, made by Prof. Stodala, as contradicting some of Mr. Christie's conclusions. This machine has an output of 2058 kw. running at 1501 r.p.m., using steam 178 lb. absolute with 182 deg. F. superheat and a vacuum of 28.4 in. equivalent to an absolute pressure of 0.74 lb. Steam consumption was 15.21 lb. per kw. hr. and the efficiency, 59.1 per cent compared to the Rankine cycle. Mr. Moyer thought that the combination impulse and reaction turbine is not necessarily more efficient than others; that only 2 rows of blades per wheel is best and one row of guide blades per stage. He considered more than 68 per cent efficiency referred to the Rankine cycle, as doubtful. He stated that the erosion of the blades is not of much consequence and doubted the efficiency of the throttling governor for turbine control.

Francis Hodgkinson stated that turbine speeds are increasing. The present practice being 1800 r.p.m. in sizes from 3000 to 1000 kw. and 1200 r.p.m. for larger sizes, when the frequency current is 60 alternations per second. For 25 alternations in sizes of 20,000 kw. the speed is 1500 r.p.m. and from 30,000 to 40,000 kw., 750 r.p.m. The blade speed of the Westinghouse impulse type machine is 350 to 500 ft. per second and for the reaction type 300 to 500 ft. per second depending on the vacuum used and other conditions.

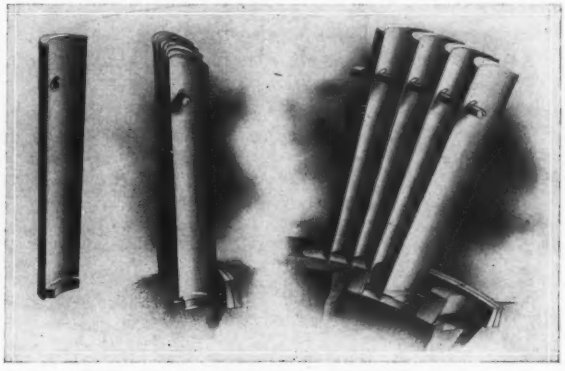
In German practice, the speed is 80 ft. per second at the pressure of 100 lb. per sq. in., but these are being increased.

He stated that the bearing temperature of 150 deg. is preferable to a cooler temperature as the friction of the oil is less at that temperature.

Many rows of blades are not desirable, because eddys are set up in the steam with resulting loss of energy. He considered the reaction type better than the impulse because in the impulse type 2 transformations of energy are necessary, from pressure to velocity and from velocity to blade. The Parsons' reaction type is subject to leakage which cuts down the efficiency, but this leakage loss can be reduced by using high speed and good proportions. A combination of the Curtis high-pressure element which cuts down the leakage loss and the reaction low-pressure element which cuts down transformation loss gives better efficiency than either type alone. He showed a view of the new Westinghouse blade which is reproduced herewith.

Mr. C. V. Kerr stated that the wear of the blades is larger in the low-pressure stages, due to wetness of the steam. In the turbine using a double cup form of blade, the wear is high in the upper stages because a large part of the energy is absorbed there and also high pressure steam is more dense. He believes that in proportioning the turbine to the generator, the turbine should be made to stall at the maximum load of the generating machines, thus acting as a safety valve for the unit.

In regard to the speed of starting, he stated that in the Kerr turbines under test the end of the exhaust pipe



NEW WESTINGHOUSE TURBINE BLADES

was not more than 10 ft. from the turbine and the exhaust steam had not reached the end of the pipe before the governor, which was set for 3000 r.p.m., went out.

Properties of Steam

A PAPER by Prof. G. A. Goodenough on the Thermal Properties of Steam gave a comparison of experimental results and attempted to get a general equation to represent the relation between temperature, pressure, volume and superheat steam which should more closely represent the results than those heretofore in use. The paper and the discussion which followed by Messrs. H. S. Davis, R. C. H. Heck, F. E. Cardullo and L. S. Marks agreed that Prof. Goodenough's equation covered the relation of the different values over the middle ranges of pressure and temperature, but showed considerable errors at low and high temperatures, the limits being 7 lb. per sq. in. and 176 deg. F. and 90 lb. per sq. in. and 320 deg; but the errors are not serious below 225 lb. and 392 deg. The equations are not satisfactory for superheat at over 720 deg.

The opinion of those discussing the paper was that it is not safe to twist experimental results to make them fit an equation, even though the test values and the steam tables are not consistent at all points. The derivation of steam tables and values by working from the physical side of the subject rather than the mathematical side is less likely to produce serious error.

Cooling Reservoirs

COOLING of Condensing Water in Reservoirs was discussed in a paper by W. E. Ruggles, presented by F. E. Cardullo, the paper will be printed in a following number. In discussing this, attention was called to the fact that the readings gave no velocities or direction of the wind and that these have a large effect on the cooling pond. In a reservoir, 90 per cent of the cooling is due to evaporation of water from the surface, which amounts to about 0.3 of a lb. per sq. ft. of surface per hr. for each lb. pressure difference between the vapor in the pond and that in the air. A small pond from which the vapor is quickly carried away by the wind or by air circulation is therefore better than a large one.

Higher air temperature in the summer months tends to better cooling than the lower temperature in the winter due to the greater capacity of warm air to absorb moisture, but this is counteracted by the higher wind velocity in the cool months so that the net result remains fairly steady.

Most of the evaporation will occur near the point where water flows into the reservoir on account of the higher temperature at that part, hence the calculation for evaporation should be based on the temperature in the reservoir intake rather than on the average temperature between intake and discharge.

Circulation of the air which carries away moisture will be from the edges of the reservoir toward the center where the hot air will rise, hence, to get the best effect the water should flow into the reservoir at the center and distribute toward the edges on the counter-flow principle. It was pointed out that great refinement in design of cooling reservoirs is a joke because the daily conditions will vary largely and the reservoir must be made to take care of the maximum need.

Safety Valve Tests

PRESENTING a paper on tests of the efficiency of safety valves, A. B. Carhart stated that the object of these tests was to find the value of a round edge as compared with the beveled edge and that the tests showed an improvement of from 12 to 15 per cent in the capacity. The tests were all day runs under trying conditions to the experimenters, the boiler room temperature frequently standing at 160 deg. The tests were made with the valves set to a certain amount of opening which, of course, is not the condition in actual service, as the lift varies, but the results of the tests show to what definite amount of opening safety valves should be set to discharge a definite amount of steam. The summary of the tests and results will be given in a later number.

Entertainment features of the meeting were especially pleasant and complete. Wednesday afternoon was devoted to the various manufacturing plants of Cleveland after a luncheon served to those in attendance in the meeting hall. The afternoon closed with a visit to the country club. Thursday afternoon was given over to an excursion on Lake Erie with opportunity for professional and social intercourse between the members in attendance, and in the evening a formal reception and dance was held at the Colonial Club. On Friday afternoon a special train carried those in attendance to Akron for a visit to the great Goodrich rubber works and to the factory of the Wellman-Seaver-Morgan Co. This closed the activities of the meeting.

At the last session, resolutions of thanks were passed to the hosts who had made the stay in Cleveland so pleasant and especially to Past President Ambrose Swasey, chairman of the local committee, and to Prof. Miller for his interesting lecture.

THE HOOSIERS

Engineering With Indiana Engineers at Evansville, June 6-8

NOT a delegate departed from the Indiana state convention with the slightest doubt as to the ability of Evansville to make good as a convention city. Ideal weather, large attendance, a good exhibit and the hospitality of the Evansville engineers served to rank the meeting of June 6-8 among the best of the state conventions of the association. Delegates and supply men began to arrive Wednesday evening and a luncheon served on the roof garden of the Hotel Vendome gave opportunity for the meeting of old friends and the formation of new acquaintances.

The Opening

THURSDAY morning the convention was opened at the Hendricks club rooms in the Furniture Building with an address by Emil Heegar, chairman. In the absence of Mayor Heilman, city attorney Geo. A. Cunningham welcomed the delegates to the city, complimenting the association on its progress and the work being done for the advancement of the engineer. Responding to Mr. Cunningham National Vice-President, John T. McGrath, spoke of the excellent reputation Evansville had already established through its reception of the convention held there in 1903.

After the usual morning session the exhibits were formally opened by F. E. Ransley, president of the Central States Exhibitors Association, who gave a short talk on the educational value of the exhibits and the importance of close association between the engineer and supply man. Adjournment was then taken until afternoon.

Following a lunch and round table discussion by the delegates, session was again resumed at 1:30 p. m., and routine business transacted after which the remainder of the afternoon was spent in viewing the exhibits. In the evening the delegates and visitors listened to an illustrated talk on the Steam Turbine by R. V. Stuerve of the Allis Chalmers Co., who explained the operation and construction of the product of that company. National Secretary F. W. Raven was introduced and told of the growth of the organization by the admission of 12 new associations during the past year, what it had accomplished in the education of the engineer, and of its aims for the future.

Business and Visits

ANOTHER business meeting occupied Friday morning in which were received the reports of committees, the afternoon being held open for visits to plants about the city. Among these was the manual training school, a building which with the high school occupies an entire city block and is equipped with wood working, foundry and machine rooms containing an excellent equipment for instruction in the mechanical trades. The school has its own plant for the production of light, heat and power, the various machines in the building being equipped with individual motor drive supplied with current from this plant.

The visitors then inspected the plants of the Cook Brewing Co. and the Evansville Brewing Co., where they were shown the processes of manufacture and entertained with samples of the product.

Early in the evening the delegates again assembled in the convention hall where Theodore Wineshank explained the various methods of heating and ventilat-

ing by the Webster Modulation Systems. Noticeable among the remarks of the speaker was the statement that while in winter air could easily be heated and any desired humidity obtained, any appreciable reduction in temperature or humidity during the summer months was a commercial impossibility at the present time because of the excessive cost entailed.

The smoker and lunch tendered to the engineers by the supply men followed.

At the Saturday morning business session of the convention Terre Haute was selected as the meeting place for 1913, and the following officers were elected: Charles Streithof, Evansville, president; Geo. R. Fields, Terre Haute, vice-president; Louis Minke, Evansville, secretary; Albert Arens, South Bend, treasurer; Albert Franke, Terre Haute, conductor; H. Randall, Anderson, doorkeeper; E. G. Heegar, Evansville, state deputy. The matter of state license for engineers was taken up and a committee appointed to confer with the state legislature in endeavor to secure the passage of the same license bill as presented 2 yr. previous.

During the last afternoon the delegates, ladies and visitors were taken on an automobile tour of the city, stopping at the aviation meet in progress at the Fair Grounds to witness a few thrillers and then proceeding to Cooks Park where, as guests of the management, they were served with a banquet and treated to a special performance in the open air theatre.

Installation of officers took place in the banquet hall, F. W. Raven officiating, and Harvey E. Smith of Terre Haute, was honored by presentation with the badge of past president.

DELEGATES AND THEIR FRIENDS AT EVANSVILLE

Exhibits

FROM THE RAW MATERIAL to the finished product, the Crandall Packing Co. displayed a full line of fibrous and metallic packings. F. M. Wheeler represented the company's interests.

AMERICAN-THOMPSON IMPROVED INDICATORS, American Ideal reducing wheels, dead weight gage testers, recording gages and American pop safety valves were exhibited by the American Steam Gage and Valve Mfg. Co., with C. S. Kiessling in charge.

SOMEONE CALLED IT AN INJECTOR but Joseph H. Meyer was there to explain that it was the Model D steam trap displayed in cross section manufactured by the V. D. Anderson Co., manufacturers of steam traps and oil filters.

WELL PACKED was the Garlock Packing Co. booth with samples of all sorts of packings including Palmyra sheet packing, fibrous, asbestos and metal covered grades, with H. J. Ramshaw there to do the talking.

WHAT HEAPS OF SCALE. The United State Graphite Co.'s booth was filled with it and W. C. Skaden was there to tell you that U. S. Graphite Boiler Compound removed it all by mechanical action. A full line of samples of the company's product was also shown.

FORCED FEED lubricators and pumps of all sizes made up the display of the Hills-McCanna Co. Robert C. Hills, president of the company, did the demonstrating.

IF IT WAS ASBESTOS IT WAS THERE—in the booth of the Johns-Manville Co., where a line of pipe coverings, packings for ammonia, steam and hydraulic machinery, and all sorts of fiber products were displayed. The representatives were J. R. Chowning, P. J. Schroeder and D. E. Jones.

LAIB CO. represented by Fred W. Davis, exhibited an assorted line of mill and mine supplies, pipe valves and fittings, belt and hose.

ALL SIZES of Jenkins Bros. valves with the renewable seats, blow-off cocks, valve disks and '96 sheet packing and tubular gaskets were in charge of A. T. Arens at one of the largest booths.

PALMETTO PACKINGS constituted the exhibit of Greene, Tweed & Co. F. E. Ransley guarded the booth and distributed those musical bugs.

ATTRACTIVELY ARRANGED were the Lunkenheimer grease cups, oil cups, lubricators, valves of every description, and whistles. Jos. H. Hewetson was the artist who did the decorating and stood by ready to boost.

DEARBORN DRUG & CHEMICAL WORKS products were evidenced by literature distributed by representatives P. T. Payne, W. O. Clark and J. F. McDonnell who kept things lively in that part of the hall.

TURBINES—not steam turbines—but nonfouling turbine check valves were the center of attraction at the H. Mueller Mfg. Co. exhibit. P. J. Freeman operated a glass-enclosed model and demonstrated the usefulness of the valve in getting rid of the dirt.

KOLKER ELECTRIC CO. of Evansville, exhibited a varied line of electrical supplies, including household appliances, spark plugs, telephone systems and searchlights.

CATCHY LITERATURE from F. S. Dodge in charge of the Hawkeye Compound Co. booth made a hit and brought the Hawkeye product into prominence.

NOKUT VALVES in any size you wanted were right there shown by W. L. Osborne for the Osborne Valve & Joint Co. Here also was the headquarters of the Central States Exhibitors Association.

WHAT'S IN THAT BOX? That was the question they all asked until W. R. Shenton arrived and opened it, displaying pressure gages, recording gages, thermometers, indicators and pyrometers, made by the Schaeffer & Budenberg Mfg. Co.

NOBODY COULD MISS Charles Cullen, the representative of The Wm. Powell Co., showing an interesting display of valves. Everyone wore a "White Star."

NATIONAL ENGINEER was represented by John W. Lane.

NOT A TROUBLESOME BELT in the plant was the statement made by F. J. Rhoades for Cling Surface. He had the photographs and the arguments right there to back it up.

IT ENTERTAINED THE CROWD—that steam trap working under pressure and separating air from water without valve leakage. F. P. Gibson was the demonstrator for the C. E. Squires Co.

THE AMERICAN ORDER AT ALLENTOWN

A Well Planned Exhibit; an Effective Convention; in Pleasant Surroundings

ALTHOUGH, DUE TO ITS LOCATION in a smaller city, the convention was not as large as that of some previous years, the surroundings were most pleasant, the attendance of delegates was good and the exhibit was well planned and decorations tastefully made. It is not every convention which is fortunate enough to have a good ball game put on every afternoon right under its windows, so that business and pleasure may be conveniently blended, and it is not every convention that is surrounded by a cool grove of great trees and is favored with a band concert specially for its benefit, and with special entertainment direct from the metropolis. For all these reasons as many as were fortunate enough to be at Allentown have much to remember with pleasure and much for which to thank their hosts.

Meetings of the American Order are alway "executive" and the business transacted is reported only to the members of the association. The delegates were

FIG. 1. THE CONVENTION HALL

conscientious in attendance at all meetings, and evidently, from the echoes that filtered through from the convention hall to the exhibit hall, the arguments were earnest and possibly at times heated, but the best of spirit seemed to prevail and delegates expressed themselves as feeling that much good had been accomplished for the Order. New officers elected for 1913 were as follows:

Past Supreme Chief Engineer, Lewis G. Schlehner, Germantown, Philadelphia.

Supreme Chief Engineer, Geo. C. Goodwin, Baltimore, Md.

Senior Master Mechanic, Thos. Montgomery, Camden, N. J.

Junior Master Mechanic, Thos. Marshall, Philadelphia.

Supreme Chaplain, Chas. O. M. Bear, Allentown, Pa.

Supreme Treasurer, Michael Helmstreidt, Jr., Philadelphia.

Supreme Recording Engineer, W. A. Harden, Atlantic City, N. J.

Supreme Corresponding Engineer, F. J. Armbruster, Manayunk, Philadelphia.

Supreme Trustee, Lewis G. Schlehner, Germantown, Philadelphia.

Supreme Inside Sentinel, Wm. J. Courtney, Columbia, Pa.

Supreme Outside Sentinel, P. A. Kirkwood, Baltimore, Md.

Supply Men's Doings

AT the meeting of the American Supply Men's Association on Tuesday morning a number of bills were read and ordered paid, a nominating committee was appointed, consisting of Hart Hill, Chas. A. Hopper, A. R. Foley, H. G. McConnaughy, and F. V. Tuthill. It was definitely decided that no representatives of supply men would be allowed in the convention hall unless their firms had paid the full rate for exhibit space, regardless of whether they had an exhibit at

FIG. 2. BOOTHS OF JENKINS BROS. AND DEARBORN DRUG & CHEMICAL WORKS

the convention or not, and it was also recommended that in future the program of the convention handled by the committee of the American Supply Men's Association rather than the local committee in order to avoid confusion as to the soliciting of funds from possible exhibitors.

At the meeting on Thursday morning final plans for next year were gone over and officers were elected as follows:

President, Frank Martin, Jenkins Bros., New York, N. Y.

Vice-President, Fred L. Jahn, Watson & McDaniel Co., Philadelphia.

Secretary, Chas. Wilhoft, N. Y. Belting & Packing Co., New York, N. Y.

Treasurer, J. W. Armour, Power, New York, N. Y.

Executive Committee, representing the Supreme Council, A. O. S. E., Geo. R. Richardson, Clifford P. Williams, Franklin R. Moore.

Executive Committee, representing the American Supply Men's Association:

H. G. McConnaughy, Dearborn Drug & Chemical W'ks., New York, N. Y.

Capt. J. E. Doughty, Geo. W. Lord Co., Philadelphia, Pa.

C. A. Hopper, Keystone Lubricating Co., Philadelphia, Pa.

Harry Winner, Garlock Packing Co., Philadelphia.

A. Richard Foley, Home Rubber Co., Trenton, N. J.

Chas. Camp, Strong, Carlisle & Hammond Co., Philadelphia.

Chas. P. Sanville, McArdle & Cooney, Philadelphia.

Lane Thompson, The Lunkenheimer Co., Cincinnati, Ohio.

F. V. Tuthill, McLeod & Henry Co., Troy, N. Y.

H. E. Souder, John R. Livezey, Philadelphia.

Director of Exhibits, Hart Hill, Lagonda Mfg. Co., Philadelphia.

Later Mr. Hill, the director of exhibits, appointed as his exhibit committee for the 1913 convention the following:

Jos. P. Manypenny, Engineering Equipment Co., Phila., Pa.

Edw. J. Rooksby, E. J. Rooksby & Co., Phila., Pa.

M. V. Cordell, The Fairbanks Co., Phila., Pa.

T. H. Desmond, The Bird-Archer Co., New York, N. Y.

John F. Swan, The Roto Co., Philadelphia, Pa.

W. A. Darrow, Elliott Co., Philadelphia, Pa.

David C. Hitchner, H. B. Underwood & Co., Phila., Pa.

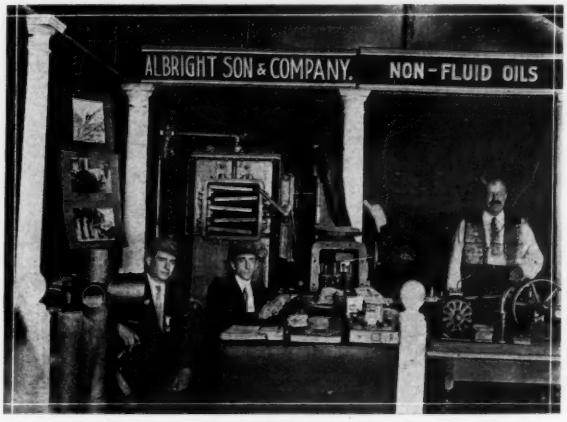


FIG. 3. COCHRANE SPECIALTIES AND NON-FLUID OIL

J. P. Everett, Hawk-Eye Compound Co., Chicago, Ill.

C. D. Brown, Westinghouse Air Brake Co., New York, N. Y.

H. Stevens, France Packing Co., Inc., Tacony, Phila., Pa.

Stanley W. Rusk, Wm. C. Robinson & Sons Co., Phila., Pa.

J. E. Fleming, National Tube Co., New York, N. Y.

J. D. Kelvie, N. Y. & N. J. Lubricant Co., New York, N. Y.

C. L. Johnson, Buhne Metal Packing Co., New York, N. Y.

J. S. Alexander, Diamond Power Specialty Co., Detroit, Mich.

L. R. Lewis, Lewis-Roth Co., Philadelphia, Pa.

W. L. Trill, Trill Indicator Co., Corry, Pa.

E. K. Morris, R. & J. Dick, Ltd., Philadelphia, Pa.

Geo. H. Dickel, Jr., Cyrus Borgner Co., Philadelphia, Pa.

L. R. Duffield, Mchy. Dept. Phila. Bourse, Philadelphia, Pa.

W. F. Bilyeu, Warren Webster & Co., Camden, N. J.

The entertainment features of the convention consisted of an entertainment by the New York bunch on Wednesday evening in the convention hall, and a band concert by the Allentown band at the same place on Thursday evening, together with the ball games already mentioned, which were played on the diamond in front of the grand stand and convention hall.

The Show

EITHER WET OR DRY Bird-Archer boiler compounds; jars of various compounds and materials, the Polarized Metallic Boiler Compound, and the pamphlet "Boiler Troubles and Their Prevention" explained why they should be used. T. H. Desmond was in charge of the exhibit.

FIG. 4. THE LUNKENHEIMER VALVE AND WATSON AND McDANIEL CO.'S EXHIBIT

JENKINS FACTS about Jenkins Valves by Jenkins Bros. was the burden of the song by McKenna & Murray at the space where the Jenkins gate and globe valves were displayed. Expansion traps, gage glass fittings and packings were included. The representatives were Frank Martin, J. McHugh, Jos. McKenna nad Billy Murray.

DEARBORN TREATMENT administered by McConnaughy and the rest, at the booth of the Dearborn Drug & Chemical Works proved good for a bad grouch as well as for bad feed water. J. W. (Pinkie) Spear, H. G. McConnaughy, Porter G. Jones and Harry J. Fey were the representatives.

NON-FLUID OILS are good for motors and good for engines as shown by the motor driven model in the exhibit of the Non-fluid Oil Co. where J. D. Kelvie explained that this is the "modern idea in lubrication."

"ARE YOU MADE RIGHT? Let's try it," was the story of the Fairbanks Co., where the scales and measuring apparatus told the story. The exhibit included valves and fittings, gasoline pumping engines and the XL standard valves. The representatives were M. V. Cordell, J. Barry, J. E. Taylor and W. Borresen.

THE BUSY DIRECTOR of Exhibits, Chas. P. Sanville, who represented McArdle & Cooney, found time, nevertheless, to explain the merits of the D. T. Williams valves, the Wright steam traps, Austin Steam and Oil Separators, Pratt & Cady Co.'s valves and the Bard Unions, assisted by H. H. Freund, Jr.

THAT WHITE ENAMELED TRAP took the eye as well as the water and Secretary, F. L. Jahn, of the Supply Men's Association, showed why it was worth while. Other specialties of the Watson & McDaniel Co. were the hydraulic steam pump governors, pressure regulators, separators, etc.

MORGANITE is grapite made into brushes for motors or generators in steel molds under hydraulic pressure and it has the connection pressed in so that it cannot come loose. This and other specialties were exhibited by the Lewis-Roth Co., represented by L. R. Lewis and R. T. Roth.

THE LUNKENHEIMER was on a pedestal of its own in the booth of the Lunkenheimer Co. Besides this central feature there was a full line of brass specialties surmounted by the motto "Quality, Efficiency and Durability" in charge of Lane Thompson and F. L. Schultze.

THE RULE AND CALIPER trade-mark made a pleasing pattern on the sheet packing which formed the back ground for

the Garlock Packing Co.'s display. Included in the exhibit were panels of cut and molded gaskets, of round and square, spiral, of rings and disks; and the big catalog of the Garlock Packing Co. explained all about them. H. N. Winner, P. H. Peck and Hugh Edwards were the representatives.

A FIBROUS BABBIT strand for any box was shown by the Buhne Metal Packing Co. in the booth where C. L. Johnson was in charge. Self lubricating and every bit good was his argument.

A CYLINDER IN THE BORING was shown in the exhibit of H. B. Underwood & Co. and also the tools used in the process. The exhibit was in charge of D. C. Hitchner and W. C. Luckensmeyer.

DIRECT FROM FRANCE, but made in Tacony were the metal packings and air lift well points exhibited by the France Packing Co. in charge of A. W. France and H. Stevens.

JUST A REMINDER of what we build was presented by Hart Hill of the Lagonda Mfg. Co. to those who visited its exhibit. This included the Lagonda multiple strainers, Weinland tube cleaners, automatic cutout valves and a model of the tube cleaner for the Stirling boiler worked from the outside.

BRICKS FOR THE BOILER made by the Hawkeye Boiler Compound Co. "Always dry and easy to use" were shown by J. P. Everett.

FIG. 5. LAGONDA CLEANERS AND SPECIALTIES AND FRANCE PACKINGS

THE RED KEYSTONE on the sky blue can gave individuality to the exhibit of the Keystone Lubricator Co. The Keystone grease in jars, in the blue cans and the Keystone oil cups were the special pets of Chas. Hopper and J. Hickey, the company's representatives.

OHIO GREASE and the way to use it were demonstrated by C. A. Hayes and R. C. Downs for the Engineering Supply Co.

THE DOUGHTY, Capt. J. E. Doughty, 40 years in the service and B. L. Lord of the Geo. W. Lord Co. furnished booklets on Boiler Troubles and Treatments and on Water Softening to help solve the problems of the boiler room.

A BUNCH OF PALMETTOS trained by F. M. Bulkley decorated the space of Greene Tweed & Co. Bulkley says, "when you have a good thing, stick to it," meaning Palmetto packings and the Favorite ratchet wrench.

THE TRILLS sang the praises of the Trill outside spring indicator with reducing motion attached and of the Trill continuous indicator for taking 200 ft. of diagram, made by The Trill Indicator Co. The representatives were W. L. Trill and G. S. Trill.

BORGNER MAKES BRICKS, fire brick shapes of all kinds and a back arch in a single piece as shown in the exhibit of Cyrus Borgner, represented by Geo. H. Dickel, Jr.

IN YOUTH it sheltered a tree in old age a pipe line, that is the cork board insulation, cork brick and Nonpareil high pressure cork blocks exhibited by John R. Livezey and his representative Harry E. Souder.

JUST HOW THE WATER FLOWS in a Webster heater was shown by the model heater and motor pump in the exhibit of Warren Webster & Co. There were included also reducing and regulating valves and other specialties. W. F. Bilyeu, John Montgomery and E. K. Webster were in charge.

IT RANG LIKE METAL, the Steel Mixture block shown by McLeod & Henry Co. and illustrated in its operation by a model boiler setting. John H. Foote and F. V. Tuthill demonstrated the advantages of the material.

KEEP CLEAN by blast and suction was the course advised by the Westinghouse Air Brake Co. showing the advantages of the Westinghouse air compressor for blowing and suction purposes in the power plant, for pumping liquids by the use of compressed air and for high pressure gas transmission. Clarence V. Brown explained how to do it.

THE ENCYCLOPEDIA of Exhaust Steam Heating was the newest idea describing the Cochrane steam specialties exhibited by Albright Son & Co. Especially representing the Cochrane specialties and the Harrison Safety Boiler was J. E. Crowley and for the Albright Co. B. F. Lynch and F. L. Mahler. Other specialties shown in this exhibit were the weldless steam heater, the Cochrane separator and back pressure valves, and the packings of the Quaker City Rubber Co., including the Daniels sheet packing and the P P P expansion packing.

PILLARS AND PANELS decorated the space of the Home Rubber Co. The pillars being of N. B. O. sheet packing and the panels illustrated the various types of gaskets, spiral twist and diagonal cushion packings made by the company. A. R. Foley and R. Valdespino were the representatives.

GIVE US LIBERTY or give us Elliot would be the natural conclusion after examining the combined exhibit of the Liberty Mfg. Co. and the Elliot Co., which included Liberty cleaners, the Elliot reducing valves and traps and the Pittsburgh feed water heater. J. P. Bretherton and W. A. Darrow did the honors.

KYMOI is a relation of the Lip and both belong to the Crandall family of packings. Other members are the Regina white sheet and the various round, square, spiral and gasket forms, all shown by the Crandall Packing Co. in charge of H. N. Crowder.

"BORING THE CYLINDER," a tale of effectiveness, was the story illustrated by E. J. Rooksby & Co. in its display, in charge of Mr. Rooksby himself.

A BREEZE FOR EVERY BOILER was the promise of the Diamond soot blower made by the Diamond Power Specialty Co. These are made for front end or rear end application for water tube, marine, horizontal return tube, or vertical boilers and to prove what they will do the pamphlet marked "What They Say" is good evidence, as explained by J. S. Alexander.

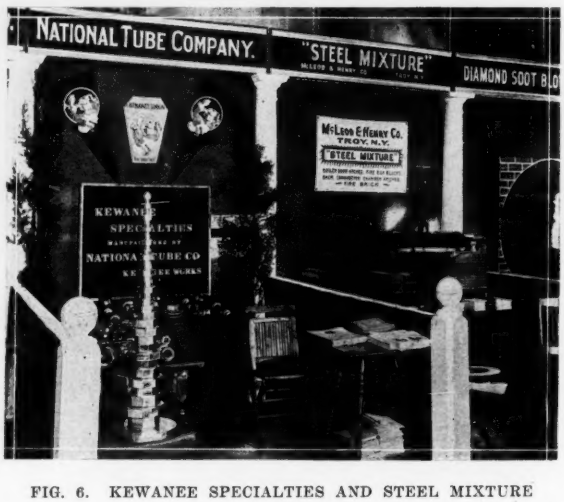


FIG. 6. KEWANEE SPECIALTIES AND STEEL MIXTURE

THE ENGINEERS CATALOG distributed by the New York Belting & Packing Co. showed its complete line of products including the Indestructible white sheet packing, Ruby red, Firo super heat steam packing, Turxo asbestos gland and angle valve packings, Cobb high pressure piston rod and Magic diagonal rubber cushion for steam ammonia and boiling water. Chas. A. Wilhoft and T. A. Ross were in charge of the exhibit.

THE WHOLE KEWANEE FAMILY was present in the exhibition of the National Tube Co. arranged in a shining totem pole of little and big unions with bronze to iron seats and an assortment of union valves and other valves both plain and regrinding. The Kewanee pennants formed a pleasing decoration to the exhibit space which was in charge of R. T. Burone, Jr. and J. E. Fleming.

TO CLEAN THE BOILER use the Roto was the claim of John F. Swan of the Roto Co. exhibiting its Roto cleaners for air, steam or water driven and for straight or bent tubes.

STRONG STEAM SAVERS filled the space of the Strong, Carlisle & Hammond Co., the main feature being a trap in section decorated in silver and gold and showing the action of the ball valve vacuum trap. Other features were the reducing valve, pump governor and the Strong quick closing valve and engine stop, explained by Chas. Camp.

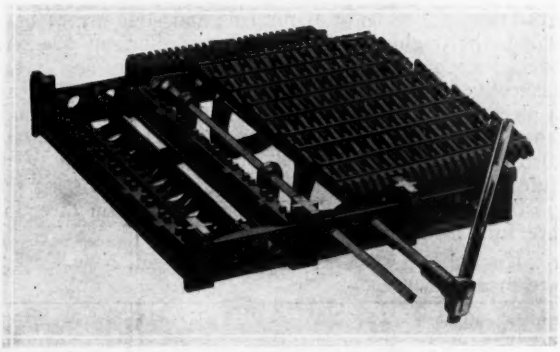
ASHTON VALVE CO. was represented by Mr. Buckman.

Power Apparatus in Shop and Market

New Ideas In Making, Buying and Selling

THE SHEAR-KLEAN GRATE

ENGINEERS will be interested in a grate which has established a reputation for itself on account of its construction, simplicity and rigidity of design. The Shear-Klean grate is the result of a desire on the part of a manufacturer of stokers to build a grate to supersede those which were merely rocking, or dumping grates. The idea being that a grate should act upon every inch of the bottom of a fire and that should eliminate the ash and clinker in horizontal layers.



THE SHEAR-KLEAN GRATE WITH PART OF THE BARS REMOVED, THE REMAINDER IN EXTREME SHEARING POSITION

Two motions are used in the Shear-Klean grate. The first motion is that of rocking all of the grate bars by simply moving the operating lever through a short arc. By pushing the operating lever in front of the boiler through a greater distance, after the rocking motion has been given to all of the bars, each alternate grate bar is shifted sidewise in both directions, thus grinding and crushing the clinker above. As the fingers of the grate bar interlock, when the shifting of the alternate bars has been accomplished, the openings between the grate bar fingers have been increased in area, thus allowing the broken clinker and ash to pass through into the ash-pit.

By reason of grinding out the bottom only of a fuel bed, no unburned fuel is wasted by being dropped into the ash-pit. The space between grate bars in their normal position is 5/8 in. for bituminous coal which increases to 1¼ in. when the shearing motion is completed.

The grate bars, in addition to cleaning the fire, clean themselves in their ordinary operation. Any coal with a great amount of sulphur and iron, which forms clinker easily will not stop up the Shear-Klean grate. The reason for this is that any freeze is cut from the fingers by the rocking action after each alternate bar has been shifted.

On account of the design of the cam operator it is impossible to leave the grate fingers sticking up into the fire to burn off, and as the grate bars are heavy, being 7/8 in. at the webb and 9/16 in. wide at the end, the fingers will not break.

The frames are tied together at the ends by separators which are rabbeted to them, making a solid construction. These separators serve a double purpose as they also act as bearings for the square steel shafts which transmit the human force to the cam operators which also have their bearings in the separators.

Grate bars are set in V-shaped grooves 1 in. high and the ¾-in. hard steel pins, which are set into and actuated by the cam slots of the operator, project for a considerable distance beyond it, eliminating the possibility of their getting out of place.

The Shear-Klean Grate Company of Chicago is a new corporation which manufactures these grates.

JUDGING BABBITT METAL

FAITH OR REPUTATION enter very largely in the selection of babbitt metals, because it is practically impossible to determine the value of such metals from their physical appearances or even to note any special difference between the various brands.

Experienced users of babbitts can of course, detect the presence of large quantities of tin or copper and determine the degree of hardness and ductility by hammering and cutting but after all what do such tests really prove? A babbitt can be made so hard that it will be very brittle and yet it is liable to wear faster and squash from frictional heat more readily than will a softer metal that possesses anti-friction qualities.

An additional quantity of tin does not necessarily improve a babbitt as too much tin in a lead base metal or the admixture of lead in a tin base metal may prove detrimental in reducing the fusing point.

For instance take 6 parts of tin and one of lead; the mean arithmetic fusing point is 470 deg. F., but the actual fusing point is 380 deg. F., or if you take 2 parts of tin to one of lead the actual fusing point will be 340 deg. F., which is in both cases, much under the fusing point of the lowest constituant in the mass and yet both mixtures would show splendid physical tests for hardness, ductility, etc.

It is generally well understood that any white metal alloy, no matter what its degree of hardness or how high its fusing point, will soften and squash if the temperature reaches around 300 deg. F., and the lower the fusing point, the more susceptible it will be to squashing if the bearing heats.

Perhaps white brass, a tin and spelter mixture, affords one of the best examples of the futility of mere hardness. It is a wonderfully hard ductile and tough metal when cool, but lacking in anti-frictional qualities, and when it becomes hot, which happens readily, it goes to pieces like putty and can be crushed by the blow of a lead pencil. Even the knowledge of the composition of a metal is no guarantee of its value

as it may be made either of the best virgin materials or, if sold at very close price, is more than likely made of recovered drosses or scrap, or other impure or burned out materials and the purchaser has no means of detecting the difference and the use of the latter metal involves waste and trouble.

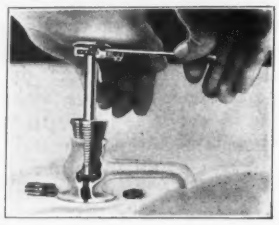
The great difference in value that can exist between 2 metals of exactly similar composition was strongly demonstrated by the United States Government in its test of Magnolia Metal, using water as the lubricant. At the instigation of the engineer officers who made the test a metal was furnished them of the same composition as magnolia but not subjected to the special foundry practice or graphite treatment. This imitation of Magnolia was made of the purest virgin materials and would class as a high grade conventional babbitt and yet in this test the genuine magnolia metal proved to be 2 hundred per cent superior anti-frictionally to the imitation.

This water test was made up to 600 lb. pressure per square inch, the limit of machine, 490 r.p.m. for 5 hours. In this test Magnolia showed the very small co-efficient of friction of 0.0008.

This test was also made "ahead and reverse" and very few babbitts will stand reversing, even with oil lubrication, as they rough up like plush rubbed against the pile.

THE SKINNER BIBB RESEATING TOOL

IN the bibb cock or faucet with compression seat, frequently the seat becomes worn or cut, and in this condition the leakage is annoying. Unless some means is available for recutting these seats in place, the faucet must be removed and replaced by a new one at a considerable cost and inconvenience.



SKINNER BIBB RESEATER AT WORK

M. B. Skinner of James McCrea & Co., has devised a reseating tool which recuts the seat of a compression cock in place without disconnecting it from the system and leaves the faucet in the same tight and satisfactory condition as when new.

Application of this tool is shown in the illustration. It consists of a sleeve tapered and threaded to fit bibs of ⅜ to ¾ in., thus giving stability and security; a stem which works through this tapered sleeve, carrying at the lower end a cutter which does the reseating; a button or hand piece at the top on which pressure is applied when operating the tool; and a ratchet which is built in and permits of operating without a full sweep of the handle. Blades are made with a shear cut instead of radiating so that they do not chatter, and are of 3 sizes to fit different sizes of faucets.

The method of using this tool is to unscrew and remove the bonnet of the faucet with its stem; put the stem of the tool with the desired cutter into the opening, sliding the tapered sleeve down over it and screwing the taper up tight. The ratchet handle is then adjusted and the button placed on top, a few turns being given without too much pressure and a few more with no pressure at all. The tool is then removed and the bonnet and stem of the faucet replaced and the operation is completed.

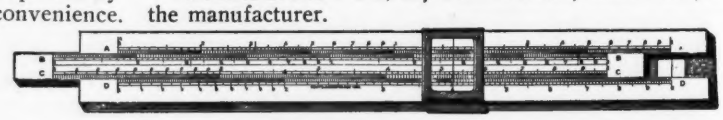
Engineers who have charge of buildings, and who have occasion to deal with compression faucets and bibb cocks will appreciate the convenience and saving which can be secured by the use of this device. The manufacturers are James McCrea & Co., of Chicago.

STUDENT'S SLIDE RULE

STUDENT'S Slide Rule, as its name implies, is intended for the use of students. It will perform all the functions of regular Mannheim slide rules, but it is made as cheaply as is compatible with correctness, so that it affords the student an opportunity to have a slide rule and to become familiar with it, without incurring the expense of obtaining the regular rule intended for professional use.

Keuffel & Esser student's slide rule is in general like the Mannheim rule; it is of the same size and has the same graduations, except that the vertical edges are not graduated. The body of the rule and slide are of hardwood, thoroughly seasoned. The graduations are on a special strong and tough white paper facing and have a protective coating. The metal indicator or runner carries a piece of thin transparent celluloid marked with a hair-line. The index mark for the under side of the slide is also a hair-line on celluloid. On the under side of the rule there is a table of the most frequently occurring proportions and formulas. With each rule plain directions are furnished.

Keuffel & Esser Co., 127 Fulton street, New York, is the manufacturer.



SLIDE RULE MADE ESPECIALLY FOR STUDENTS OR BEGINNERS

BEAVER SQUARE END PIPE CUTTER

PRACTICAL HAND PIPE CUTTER

CUTS a pipe almost like butter." So says the Borden Co., of Warren, Ohio, about its new pipe cutter. And such a statement from the Borden Co., with its years of experience and reputation for building efficient die stocks, deserves attention. A description of the Beaver Square End pipe cutter follows:

The secret lies in producing a cutter with knives which sever the pipe exactly as does a lathe tool. This, Mr. A. F. Howe, vice-president, accomplished, the form of knives used being similar to a carpenter's plane. The knives are fed into the pipe automatically, and as they revolve shave a narrow gutter around the pipe. The operator simply turns the machine by 2 handles precisely like a die stock. Size No. 5 shown herewith cuts a ½ to 2 in. pipe.

The Borden Co. claims that this Beaver Square End pipe cutter severs a pipe perfectly square and clean; leaves no burr to file off or ream out, and so preserves the full inside pipe opening. That it cannot split a pipe and the perfectly square pipe end makes

threading dies start more easily, run straight and last longer. That the tool is strong and durable and its knives will cut many hundred pieces of pipe without regrinding. A circular to be had on request goes more into detail.

NEWS NOTES

RICHARDSON SCALE COMPANY announces the removal of its main offices from 3 Park Row, New York City, to the Factory of the company at Passaic, New Jersey. All communications should hereafter be addressed to Richardson Scale Company, M. O. Department, Passaic, N. J. A local sales office will be maintained in New York City, and will be located at 826 Park Row Building, Mr. J. C. Kay will be in charge.

ANNOUNCEMENT IS MADE of September 6-7 as the dates for the second annual meeting of the Institute of Operating Engineers to be held at the New York Headquarters 29 W. 39th St.

THE UNITED STATES CIVIL SERVICE COMMISSION announces an examination on July 10, 1912, at principal cities of the United States to fill a vacancy in the position of laboratory aid and engineer at $900 per annum, in the forest products laboratory at Madison, Wis. The duties consist, in general, of the operation and care of the mechanical appliances used in the laboratories. Applicants for this examination should be of good physique, as they may be required to handle heavy timbers and to do general work in pipe fitting and setting up and modification of machinery.

The examination will consist of the subjects mentioned below, weighted as indicated: Arithmetic, 10; operation and care of boilers, motors, shafting, etc. (including a general knowledge of the processes involved in the manufacture of wood pulp), 30; training, experience, and fitness, 60. Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any examination place, for application and examination Form 1312.

ON JUNE 1st the consolidation was announced of the three associated companies heretofore known as the Alberger Condenser Co., Alberger Pump Co., and the Newburgh Ice Machine & Engine Co. The new company will be known as the Alberger Pump & Condenser Co., and will have as officers: Pres., Geo. Q. Palmer; vice-presidents, Wm. S. Doran and D. H. Chester; secretary-treasurer, Wm. R. Billings. The main offices will be at 140 Cedar St., New York. Because of the large amount of condenser and centrifugal pump orders important additions have been made to the plant and equipment of the works at Newburgh, N. Y., some of the orders now being executed being for the U. S. Navy Department, Panama Canal Commission, U. S. War Department, American Gas & Electric Co., Cleveland Electric Illuminating Co., and the Robin's Dry Dock & Repair Co., these orders including as well as condensers and centrifugal pumps, cooling towers, feed-water heaters, hot water heaters and expansion joints.

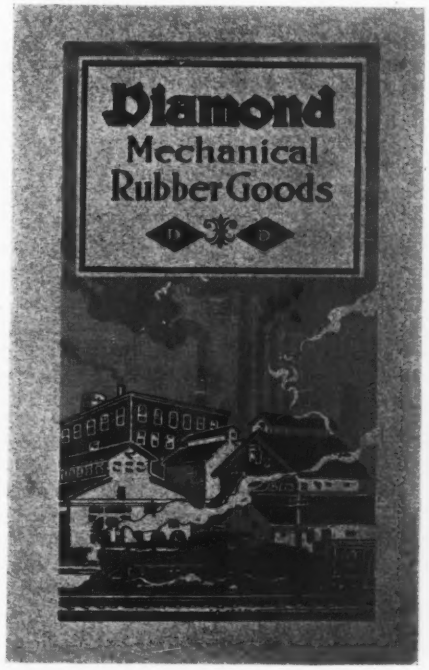
THE ILLINOIS WORKMEN'S COMPENSATION LAW, which went into effect May 1st, has the appearance of having been passed without careful consideration as to the justice of its provisions. All thoughtful employers recognize their responsibility for "more than wages" which rests upon them, but the burden thrown upon industry by the Illinois Law is greater than is warranted in certain provisions and has been greatly increased by the attitude taken by the casualty companies. These companies have increased their premium rates to an average of more than three times what is necessary to cover the cost of insurance. This cost has been fairly well determined by experience and by those companies who have a voluntary provision for compensating injured employes, but the casualty companies have paid no attention to this data. An amendment recently adopted by the Illinois Legislatures authorizes the adoption of Inter-insurance whereby employers and corporations may provide their own insurance on a mutual basis and obtain the desired protection at actual cost. The plan is safely guaranteed because all matter must be approved by the Insurance Superintendent of the state and all organizations securing a license to do this kind of business must reach a standard fixed by him. In order to put this on a working basis an Inter-insurance Exchange is now in process of forming and information may be obtained from R. M. Potts, Ridgely National Bank Bldg., Springfield, Ill.

CORRECTION NOTE

IN the June 15 number, page 650, sixth line of the second column, a typographical error was printed which reversed the intended meaning. The last word of the paragraph should be "unlimited" instead of "limited" as printed there.

CATALOG NOTES

ONE OF THE MOST ARTISTIC and complete catalogs of Mechanical Rubber Goods that we have ever seen has recently been issued by the Diamond Rubber Co., Akron, Ohio. It consists of 160 pages. Each page is a tint block with a half tone of the article described at the top and the product in actual service shown at the bottom. Reading matter is attractively arranged around and between the half tones. The color combination is brown and red on a black tint.



It is divided into sections on Transmission Belt, Conveyor Belt, Hose, Packing, Moulded Goods, Mats and Matting, Hard Rubber. Also an additional section is devoted to Diamond tires and other Diamond products.

Valuable information covering data on Belting, Hose, Packing, etc., is scattered plentifully throughout the entire book.

A very clever scheme is carried out in the end sheets, which are a series of the Diamond trade marks with the characteristic word "Diamond" diagonally across the double page spread.

The cover is very artistic. The design illustrates the wide range of industries that use Diamond products.

FROM JOSEPH DIXON Crucible Co., Jersey City, N. J., we have received five new booklets entitled: A Study in Graphite, Graphite as a Lubricant, Air Compressor Lubrication, The Proper Care of Belts and Dixon's Graphite Brushes. The Dixon products are so well known that no comment is necessary.

AMERICAN SPIRAL PIPE WORKS, Chicago, have issued a new bulletin. The new forged steel fittings presented in this pamphlet represent the best practice in piping installation, and comply in detail with the demand for connections of absolute dependability.

THE BOOK "Feed Water Filtration" published by James Beggs & Co., New York, has just been isued in a fourth edition.

ENGINEERS INTERESTED in coal pile savings will like to read an unusual book issued by the Skinner Engine Co., of Erie, Pa., entitled Engines for $1. The method of paying for an engine outlined therein is unique and emphasizes the faith of the builders in the performance of their machines.

REEVES STEAM ENGINES are of vertical compound type with balanced adjustable piston valves and automatic inertia and balanced governor has many unique features which are fully set forth in catalog R issued by the Trenton Engine Co., of Trenton, N. J. Engineers will find the details an interesting study and the steam consumption, as shown by the published tests, important for comparison.

THE ACME DUMPING GRATE as made by the Acme Furnace Equipment Co., of New York City, is designed for burning anthracite or bituminous coals and has several unique features which are fully shown in the catalog recently issued, entitled "The Acme in Grate Bar Practice."

CATALOG B of the Alberger Pump Co., of New York, describes Alberger centrifugal pumps and Alberger steam turbines adapted for driving such pumps. Under the heading of pumps are described the volute, the single and multistage turbine pumps, condenser pumps, fire pumps, mine pumps, boiler feed pumps, elevator pumps, and water works pumps. These are adapted for operation by motors, engines, turbines, gas and gasoline engines, or hydraulic turbines and belts. The catalog gives full description and illustration of the different types and sizes with sectional views showing construction of runners, bearings and casings. At the end are also given brief descriptions of the Alberger hydraulic turbines, and the Alberger centrifugal condensers.

AN INTERESTING BOOKLET on the Monash Noiseless System of Vacuum Heating can be secured of the manufacturers, Monash-Younker Co., 1407-1417 W. Jackson Blvd., Chicago.

ERIE SAND-GRAVEL Dredging Pumps and Erie High Duty Centrifugal Pumps are the titles of Bulletins 27 and 28 issued by the Erie Pump & Engine Works, Erie, Pa.

MODERN METHODS AND APPARATUS for Industrial Gas Analysis is a reprint of a paper by F. M. Williams, read before the the industrial chemists and chemical engineers at Washington, D. C. This explains some improved gas apparatus, which has been devised by Mr. Williams, and gives the general principles of gas analysis and the method of using the apparatus. It also shows a model analysis giving the readings and how the precentages of the different constituents of the gas are derived from the readings. Copies of the paper may be had from F. M. Williams, Watertown, N. Y.

DEPARTMENT OF THE INTERIOR, Bureau of Mines, has the following new publications for distribution: Bulletin 36. Alaskan coal problems, by W. L. Fisher. 1912. Technical Paper 12. The behavior of nitroglycerin when heated, by W. O. Snelling. 1912. Technical Paper 13. Gas analysis as an aid in fighting mine fires, by G. A. Burrell. 1912. Technical Paper 16. The deterioration and spontaneous combustion of coal in storage, by H. C. Porter and F. K. Ovitz. 1912. Miners' Circular 6. Permissible explosives tested prior to January 1, 1912, and precautions to be observed in their use, by Clarence Hall. 1912. Reprint, Bulletin 37. Comparative tests of run-of-mine and briquetted coal on locomotives including torpedo-boat tests and some foreign specifications for briquetted fuel, by W. F. M. Goss. Reprint of United States Geological Survey, Bulletin 363.

The Bureau of Mines has copies of these publications for free distribution, but can not give more than one copy of the same bulletin to one person. In asking for publications order them by number and title. Applications should be addressed to the Director of the Bureau of Mines, Washington, D. C.

BULLETIN No. 24, "The Economy Steam Turbine for Belt Drive" has just been published by The Kerr Turbine Co., Wellsville, N. Y. This bulletin shows belted Economy turbine installations which are effecting marked economies over apparatus previously used. A free copy will be mailed to anyone interested.

SOME MONTHS AGO the International Acheson Graphite Co., Niagara Falls, N. Y., printed a very large edition of its booklet entitled Graphite Lubrication. So great was the demand for this work that it has been necessary to reprint a still larger edition of the work, which is recognized as a leading reference on the use of graphite as a lubricant, and tells of the application of pure graphite in the field of lubrication, a graphite which is available in many forms.

In this age of wonderful speeds and tremendous pressure, it means much in the matter of safety that a solid lubricant such as pure, gritless Acheson-Graphite is available for the use of man in overcoming friction. The various grades of this graphite are each made with its contemplated use and application fully determined, and each grade is made to fit an individual need.

THE GENERAL ELECTRIC COMPANY recently issued Bulletin No. 4910 which is devoted to Oil Break Switches for 600, 4500 and 7500 volt alternating current circuits. This is known as the Type F, Form K-5, switch, and is a switch of moderate rupturing capacity, liberally designed, conservatively rated, and simple in construction and operation. The bulletin enters into the details of construction and contains dimension and connection diagrams.

Sparks From The Advertising Pages

The manufacturer who makes a product that is already well known as thoroughly reliable does well to keep up his advertising, despite his reputation, as the following letter clearly illustrates. Mr. Meyers was bound to have the valves he wanted and no substitute would do. If every engineer were as insistent there would be less overtime spent in trying to make the all too numerous inferior product do the work of the genuine. Mr. Meyers says:

Buffalo, N. Y., May 3d, 1912.

Advertising Editor,
Practical Engineer,
537 So. Dearborn St., Chicago, Ill.

Gentlemen:

(1) The advertisement which attracts me most and makes me want to read it is that of Jenkins Bros., because they advertise in a large way and with little reading matter. But the sign of the trade-mark goes a great way.

About the trade-mark I would like to say a few words. I had some 20 radiator valves to be replaced recently and the manager asked me what kind of valve I wanted put in. I said I wanted Jenkins Bros.' valves, so he gave the order to a local steam fitting firm with the understanding that the valves must be Jenkins Bros., which he agreed to in signing the contract.

Now, when the job was done and the bill came to me to be O. Kd., I told the manager that I would not O. K. it because the valves were not Jenkins Bros. The head of the steam-fitting concern came to see me and said that he would bet $10 that they were Jenkins Bros. disks. I told him that the disks didn't make them Jenkins Bros. valves and the bet was off.

The firm would not pay the bill until a long time after when he agreed to make a large reduction in the price rather than take the valves out.

(2) I think the Jenkins Bros. advertisement is also the most interesting because what they say means so much to the man who has had valve troubles.

(3) It is also the most convincing because where I had trouble with a valve, I put in a Jenkins and found that what they say is so.

(4) I answered the Jenkins Bros. advertisement because it was the first time I have ever known them to give away books on valves—something which I think every engineer should have.

Yours very truly,
A. M. Meyers,
39 Letchworth St.,
Buffalo, N. Y.

The value of realism in advertising is well brought out by Mr. Geo. Van Vlack, who selects the advertisement of the Peerless Rubber Co., because it "depicts a condition well known to every engineer." Advertisements which bring up a situation with which the reader has himself been identified are invariably sure of close scrutiny. Mr. Van Vlack says:

Rochester, N. Y., May 21, 1912.

Advertising Editor,
PRACTICAL ENGINEER,
537 South Dearborn St., Chicago, Ill.

Gentlemen:

(1) The advertisement of the Peerless Rubber Co., 16 Warren St., New York, appeals to me as being the most attractive in the PRACTICAL ENGINEER, for the reason that it depicts without words, a condition well known to every running engineer. The cut is exceptionally good (with the exception of the reach rods from wrist-plate to bell cranks on l.p. side of the Corliss engine), the troubled expression on the countenance of the engineer is very expressive, and the "boss" is a little excited,—no uncommon occurrence.

(2) The advertisement of the Eureka Packing Co., 74-76 Murray St., New York, is the most interesting to the average engineer, in that it describes the conditions of this class of men and appeals in a very sensible manner to just that class of men whom the advertiser is most desirous of reaching, viz., the running engineers.

(3) The advertisement of the Ashton Valve Co., Boston, Mass., is the most important and convincing in my estimation, for the reason that it deals with conditions most vital to the engineer, i. e., the safety of his equipment.

(4) I have answered the following advertisements: Jenkins Bros., 80 White St., New York, and Wheeler Condenser & Engineering Co., Carteret, N. J., and the Westinghouse Machine Co., East Pittsburgh, Pa.

Very truly yours,
Geo. Van Vlack,
272 Emerson St.

Both of these letters have emphasized the value of advertising copy which reminds the engineer of some incident connected with his own experience—copy which brings his own necessity clearly before him. This is the result which the writer of advertisements strives for. No matter how good a product may be made to appear, the desired action cannot be attained unless the reader is made to realize how perfectly it fits his own particular needs.

PRACTICAL ENGINEER CLASSIFIED ADVERTISEMENTS

Advertisements in this section are inserted under regular headings at the rates of 30 cents per line. About nine words make a line. No display type allowed, but the first three words may be set in capital letters. Minimum space sold, two lines.

Under classification, "Positions Wanted," advertisements not exceeding four lines will be inserted for subscribers once free of charge.

To insure proper classification, copy must reach this office 10 days preceding publication.

Positions Wanted

POSITION WANTED—By a stationary engineer who had experience with high speed and Corliss engines, condensers, a.c. and d.c. dynamos, and motors; has own steam indicator, and holds chief engineer's license for Minnesota. Can give A1 references. Address Box 231, care Practical Engineer, Chicago, Ill. 7-1-1

POSITION WANTED—Young man desires position in large plant where there is a chance for promotion. Two years' experience. Address W. K. Mann, Box 21, Milan, Mo. 7-1-1

POSITION WANTED—As chief or operating engineer, 10 years' experience on all kinds of steam and electrical power plant machinery. Age, 38; temperate, steady and reliable. Chicago City and State of Minn. chief engineer's license. Address Box 228, Practical Engineer, Chicago, Ill. 7-1-1

POSITION WANTED—By a college engineer, 31 years, single, with over 6 years' outside experience in the running and setting up of steam, gas and gasoline engines of all kinds. Address Box 226, Practical Engineer, Chicago, Ill. 7-1-1

Help Wanted

AGENTS—AT ONCE. Something new. Model Spring Winder. Guaranteed for life. Makes springs any size from any kind of spring wire. Wonderfully rapid. Efficient and powerful machine. Sells quickly to factories, shops, mills, garages, printing houses, newspaper publishers, etc. Indispensible wherever there's a machine with springs on it. Saves time, worry and money. Attaches in a minute to any workbench or table. Sell one, make $2.50 profit. You can sell 10 a day. Big folder tells all. Write National Mfg. & Sales Co., 322 Huron St., Toledo, O. 7-1-3

WANTED—EXPERIENCED SPECIALTY SALESMAN in every large town in U. S. Must be a live wire and acquainted with manufacturing trade. Proposition is high grade. Must be financially able to carry small stock for immediate delivery; also capable of appointing and directing agents. Good man can easily earn $3,000 to $5,000 yearly. Address, with references, Box 229, Practical Engineer, Chicago, Ill. 6-1-1

WOULD ONE HUNDRED DOLLARS per week interest you? Would you like to be outside in the fresh invigorating air during the coming months? Free to do your own bidding and earning $100.00 or more per week, as you choose? Your own boss. We want one first-class salesman to represent us, in every city in the United States, to sell our high-grade specialties to Engineers. Exclusive territory given. Strong Machinery & Supply Co., 48 Franklin St., N. Y. C. tf

AGENTS WANTED—WE WANT a live-wire agent, either engineer or specialty salesman in every town to furnish lists of names and take orders for Akron Metal Gaskets, the most complete line of metal gaskets made. Write for our proposition. Akron Metallic Gasket Company, Dept. PE., Akron, Ohio. tf

HELP WANTED—ENGINEER WANTED in every city and town to instruct our customers in indicator practice. If you have a fair working knowledge, we will "do the rest." Good pay to reliable, intelligent men. Write for particulars. Lippincott Co., Newark, N. J. tf

WANTED—SALES AGENTS to sell Goetze Metallic Packings of good reputation. Write us. Goetze Gasket & Packing Co., New Brunswick, N. J. 6-15-12

Wanted

WANTED—To correspond with manufacturers regarding the manufacture and placing on the market of two good patents having practically an unlimited field for their operation. Address P. O. Box 30, Falling Spring, W. Va.

WANTED—EVERY ENGINEER to have our pamphlet for setting valves on Corliss Engines, simple and compound, with one or two ecentrics. Sent free. Lindstrom's Machine Works, 200 South Third St., Allentown, Pa. tf

WANTED—WE WANT TO BUY a good patented Steam Specialty. Address Box 233, Practical Engineer, Chicago, Ill. 7-1-2

WANTED—ALL STEAM USERS to have clean boilers without using compounds or chemicals in any form. Write "Otis," No. 317 Norfolk Ave., Buffalo, N. Y. tf

IF YOU ARE a night engineer, spend a few hours each day taking subscriptions for Practical Engineer. You will be paid well. Write the Subscription Dept. They will start you in at once. tf

For Sale

FOR SALE—INDICATOR, REDUCING WHEEL, planimeter, best make, in fine order. Examination allowed before payment, Price low—in fact, a sacrifice. Address Mrs. N. L. Browning, East Orange, N. J. tf

FOR SALE—500 HORSEPOWER right-hand engine; simple Corliss heavy duty frame, size 24x48, complete, including flywheel, 18 ft. diameter, grooved for 14 turns 1⅜-in. rope, American drive-steam receiver separator, 7-in. steam pipe including one long radius bend and flanges; can be seen in operation at our mill in Mt. Carmel, Ill. Address Bernet Craft & Kauffman Mlg. Co. Office 1036 Pierce Building, St. Louis, Mo. 7-1-4

FOR SALE—WAINWRIGHT HEATER, 400 H. P. copper corrugated tubes, excellent condition, low price, Harris Machinery Co., Minneapolis, Minn. 7-1-6

Patents and Patent Attorneys

FIND OUT FOR YOURSELF what to invent and how to protect it. My book, "Inventors' Universal Educator," covers the matter from A to Z; also gives 600 Mechanical Movements and 50 Perpetual Motions. Price $1.00, postage free. Money returned if not more than satisfactory. F. G. Dieterich, 618 Ouray Bldg., Washington, D. C.

PATENTS—C. L. Parker, Attorney-at-Law and Solicitor of Patents. Patents secured promptly and with special regard to the legal protection of the invention. Handbook for inventors sent upon request. 186 McGill Building, Washington, D. C. tf

PATENTS OF VALUE—Prompt and efficient service. No misleading inducements. Expert in Mechanics, Book of Advice and Patent Office Rules free. Clements & Clements, Patent Attorneys, 727 Colorado Bldg., Washington, D. C. 5-15-6

PATENTABLE IDEAS WANTED—Send for 3 free books. R. B. Owen, 28 Owen Bldg., Washington, D. C. tf

PATENTS—H. W. T. Jenner, Patent Attorney and Mechanical Expert, 608 F. St., Washington, D. C. Established 1883. I make a free examination and report if a patent can be had and the exact cost. Send for full information. tf

Educational and Instruction

FREE TUITION BY MAIL—Civil service, drawing, engineering, electric wiring, agricultural, poultry, real estate, auto mobile, law, normal, academic, bookkeeping, shorthand courses. Matriculation, $5. Write for our free plan. Apply to CARNEGIE COLLEGE, Rogers, Ohio. 5-15-6

Miscellaneous

IRON, BRASS and Aluminum Castings, Metal Specialties, Patterns, Models, Polishing, Plating and Japanning, North Chicago Tool Works ,65 Grove Ave., North Chicago, Ill. 6-1-12

EVERY ENGINEER should be posted regarding the new system of vacuum heating installed without payment of royalty; I have valuable information; write today. M. Y. C., 1413 W. Jackson Blvd., Chicago, Ill. tf

MAKE MONEY on the side. Here's your chance to pick out some money for yourself. Get subscriptions for Practical Engineer. It pays well. Just drop a line to the Subscription Dept. They will tell you how. tf